EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS

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Submitted By

DR. JASMEET KAUR

DEPARTMENT OF IMMUNO HEMATOLOGY AND BLOOD TRANSFUSION
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA, PUNJAB

DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled **"EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS"** submitted towards partial fulfillment of the requirements for the award of **MD IN IMMUNO HEMATOLOGY AND BLOOD TRANSFUSION** degree to BFUHS is a compilation of original work carried out by me under the supervision of **Dr. Sonia Gupta,** Associate Professor, Department of I.H.B.T., **Dr. Amarjit Kaur**, Professor & Head, Department of I.H.B.T., & **Dr. Rajesh Kumar,** Professor, I.H.B.T. No part of this thesis has formed the basis for the award of any degree previously.

_____

DR. JASMEET KAUR
Department of I.H.B.T.
Dayanand Medical College & Hospital,
Ludhiana, Punjab

Date:

Place:

CERTIFICATE OF SUPERVISORS

This is to certify that the work incorporated in this thesis entitled **"EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS"** has been carried out by **Dr. Jasmeet Kaur** under our direct supervision. The data incorporated in this thesis is original and genuine and has been carried out by the candidate herself.

Signature of Supervisor

Dr. Sonia Gupta
Associate Professor
Department of I.H.B.T.
DMCH, Ludhiana

Signature of Co-Supervisors

Dr. Amarjit Kaur
Professor & Head
Department of I.H.B.T.
DMCH, Ludhiana

Dr. Rajesh Kumar
Professor
Department of I.H.B.T.
DMCH, Ludhiana

Date:

ENDORSEMENT BY THE HEAD OF THE INSTITUTE

This is to certify that the thesis entitled **"EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS"** is a bonafide research work done by **Dr. Jasmeet Kaur** under the supervision of **Dr. Sonia Gupta,** Associate Professor, Department of I.H.B.T., **Dr. Amarjit Kaur**, Professor & Head, Department of I.H.B.T., & **Dr. Rajesh Kumar,** Professor, Department of I.H.B.T., in this institution.

Principal

Dr. Sandeep Puri
Principal
DMC&H, Ludhiana

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Signature

Dr. Jasmeet Kaur
Department of I.H.B.T.
Dayanand Medical College & Hospital,
Ludhiana, Punjab

Date:

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Dedicated

to

my beloved mother,

Sarabjeet kaur

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Dr. Jasmeet Kaur

LIST OF ABBREVIATIONS

- **AHTR** -Acute Hemolytic Transfusion Reaction
- **ARDS** - acute respiratory distress syndrome
- **ATR** – Acute Transfusion Reactions
- **BNP**- Brain Natriuretic peptide
- **C3a/C5b**- Complement 3a/ Complement 5b
- **CMV**- Cyto-megalo- Virus
- **CT**- Computerized Tomography
- **DAT**- Direct Antiglobulin test
- **DHTR**- Delayed hemolytic transfusion reactions
- **DIC** - Disseminated intravascular coagulation
- **DSTR**- Delayed Serological transfusion reactions
- **EBV** – Epstein Barr Virus.
- **FFP**-Fresh Frozen Plasma
- **FNHTR**-Febrile Non-Hemolytic Transfusion Reaction
- **HIT**- Heparin-induced thrombocytopenia.
- **HLA**-Human Leukocyte Antigen
- **HPA** -Human Platelet Antigen.
- **HTLV-** Human T cell lymphotropic Virus
- **HTR**- Hemolytic Transfusion Reaction
- **Ig** -Immunoglobulin
- **IL**- Interleukin
- **ISBT**- International Society for Blood Transfusion
- **LAH**- Left Atrial Hypertension.
- **LR** – Leuko-reduced

- **MAC**- Membrane Attack Complex.
- **MDS**- Myelodysplastic Syndrome
- **NP** – Natriuretic Peptide
- **NT-Pro-BNP**- N Terminal Pro b type natriuretic peptide.
- **P/F** – arterial oxygen partial pressure / fractional inspired Oxygen.
- **PC**- Platelet concentrate
- **PLTs**- platelets
- **PRBCs**- Packed Red blood cells.
- **Pr-SLR** - Pre storage leuko-reduced
- **PTP**- post-transfusion purpura
- **RANTES**- Regulated upon Activation, Normal T Cell Expressed and Presumably Secreted
- **RBCs**- Red blood cells.
- **SOPs**- standard operating procedures.
- **TAAR**- transfusion-associated adverse reactions
- **TACO-** Transfusion associated circulatory overload.
- **TAD** -Transfusion associated dyspnoea.
- **TA-GvHD**- Transfusion associated graft vs. host disease
- **TAH**- Transfusion associated Hypotension
- **TNF α-** Tumour Necrosis Factor-α
- **TRAE** – Transfusion related adverse events.
- **TRALI**- Transfusion related acute lung injury.
- **TRIM**- Transfusion related immunomodulation
- **TTBI**- Transfusion transmitted bacterial infections
- **WBCs**- White Blood Cells.

ABSTRACT

Introduction: Transfusion of blood products is a double-edged sword and should be used judiciously. Improvements in donor screening and transfusion transmissible diseases testing procedures have led to a decrease in the hazards and risks that are associated with transmission of the infectious diseases associated with blood transfusion. However, the risks of non-infectious complications have become more apparent. These non-infectious complications called as adverse transfusion reactions (ATRs) can either be acute in nature or follow a delayed course. Knowledge of these ATRs will help us to prevent its occurrence by taking precautionary and adequate measures and ensuring blood safety.

Aim of Study: To evaluate the rate of transfusion related adverse events between leuko-reduced and non-leuko-reduced packed red blood cells.

Materials & Methods: For a period of one year all the adverse events related to transfusion of leuko-reduced and non-leuko-reduced packed red blood cells in various clinical specialties were recorded and evaluated.

Results: During the study period, 23842 units of total packed red cells units were transfused to patients admitted in various clinical specialties. Out of 23842 units transfused, non-leuko-reduced packed red blood cells-14383 Leuko-reduced packed red blood cells- 9459. 79 patients (0.3%) experienced transfusion related adverse events during or after transfusion within 24 hours. Out of 14383, 67(.5%) cases were from non-leuko-reduced PRBCs. Out of 9459, 12 (0.1%) cases were from leuko-reduced PRBCs.

Conclusion: Our study showed that the rate of Transfusion Related Adverse Events in PRBCs units decreased significantly after inline leuko-reducing filters were installed before storage, especially FNTHRs, although residual FNHTRs are caused by the accumulation of cytokines and chemokines during storage of cellular blood products.

Keywords: Pre-storage leuko-reduction, post storage leukoreduction, transfusion related adverse events, risk associated with transfusion, transfusion-transmissible diseases.

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KEY TO MASTER CHART

✓ M	Male
✓ F	Female
✓ D	Non-leuko-reduced PRBCs
✓ I	leuko-reduced PRBCs
✓ P	Positive
✓ N	Negative
✓ WNL	With in normal limits
✓ +	Positive
✓ -	Negative

INTRODUCTION

Several decades ago, the only alternative for the treatment of anaemia, platelet abnormalities, hypovolemia, and numerous other related diseases was the transfusion of whole blood. Since the discovery that blood can be broken down into its numerous cellular and acellular components, such as RBCs, WBCs, platelet concentrates, plasma, and Cryoprecipitate, the transfusion concept for allogeneic blood has fundamentally changed. Because of their use in the treatment of disease, blood and blood components are now treated as drugs. Blood transfusions can save lives, but they also carry a number of risks.

To ensure patient safety, blood transfusion complications must be reported so that risk factors can be identified and preventive measures can be taken. Appropriate use and careful monitoring for early detection of adverse effects and their treatment are also essential. Prior to the discovery of blood group antigens, approximately one-third of transfusions in humans had an adverse outcome, often resulting in death.[1] With the discovery of blood group antigens by Karl Landsteiner in 1901, transfusion therapy went from being a risky therapy to a largely risk-free procedure. As technology developed, so did safety from transfusion-transmitted infections. The prevalence of adverse events caused by human error, ABO incompatibility, alloimmunization, bacterial contamination, and immunomodulation phenomena remain of concern. Even as modern testing facilities strive to minimize the incidence of transfusion-transmitted diseases.

Definitions

The International Society for Blood Transfusion (ISBT) working group on Hemovigilance has proposed standard norms for monitoring non-infectious adverse transfusion events.[2]

Adverse event:

It is an undesirable and unintended occurrence before, during, or after a transfusion. It may be due to an error or accident, and a reaction may

or may not occur. Incidents, near misses, and reactions are all included.

Incident: when a patient receives a blood component intended for another patient but does not meet all the criteria for a proper transfusion for that patient. This may or may not result in a negative outcome.

Near miss: an error or deviation from standard operating procedures (SOPs) or standards that is discovered prior to transfusion and could have resulted in an inaccurate transfusion or a reaction in the recipient is referred to as a "near miss"

Adverse Reaction: An unfavourable outcome or response in a patient that is temporally related to the administration of blood or blood components.

Serious Adverse Reaction: is an unexpected reaction in a donor or patient related to the collection or transfusion of blood or blood components that is fatal, life-threatening, disabling, or may result in or prolong hospitalisation or illness.

Sentinel events: are errors or occurrences that, although completely preventable, unintentionally cause significant harm to the patient and require immediate attention.

The following are some transfusion-related incidents.[3]

- Inappropriate transfusion of blood components.
- Transfusion with a ABO mismatch
- Wrong sample in the tube (misidentification with similar names).

Classification of transfusion reactions:

Typically, transfusion related adverse events are categorised based on:

Acute reactions are those that happen within 24 hours of the transfusion; rest is delayed.

• The reaction's triggering mechanisms.

1. immune
2. non-immune

Acute transfusion reactions

a. Immune-mediated

- Hemolytic transfusion reactions (HTR)

- Febrile non-hemolytic transfusion reactions (FNHTR)
- Allergic reactions
- Anaphylaxis
- Transfusion related acute lung injury (TRALI)

b. non-Immune mediated

- Transfusion associated circulatory overload (TACO)
- Transfusion associated dyspnoea (TAD)
- Transfusion associated hypotension (TAH)
- Metabolic complications
- Transfusion transmitted bacterial infections (TTBI)

Delayed transfusion reactions

c. Immune mediated

- Delayed hemolytic transfusion reactions (DHTR)
- Delayed serological transfusion reaction (DSTR)
- post-transfusion purpura (PTP)
- Transfusion associated graft vs. host disease (TA-GvHD)
- Transfusion related immunomodulation (TRIM)

d. non-Immune mediated

- Transfusion transmitted viral infection
- Transfusion transmitted malaria
- Transfusion transmitted prion disease
- Iron overload [4]

Hemolytic transfusion reactions

A hemolytic transfusion reaction occurs when transfusion results in symptoms and clinical or laboratory evidence of enhanced red cell oxidation. Blood loss can be sudden (acute), delayed, intravascular, or extravascular.[2] Usually, a transfusion of red blood cells (RBCs) causes it.

However, it can also occur when plasma-containing blood components are transfused, like platelet concentrates (PC) or fresh frozen plasma (FFP), which both contains red cell antibodies.

Table no. 1 classification of Hemolytic transfusion Reactions.

Type of reaction	Clinical / Lab features of Hemolysis
Acute hemolytic (AHTR)	<24 hours
Delayed hemolytic (DHTR)	>24 hours

Signs and symptoms:

Fever, rigors/chills, flushing of the face, a chest pain, stomach ache, aching back or flank, Nausea/vomiting, Diarrhoea, Hypotension, Pallor, Jaundice, Oligo/anuria, diffuse bleeding, dark coloured urine.[3]

Febrile non-hemolytic transfusion reaction:

FNHTR is defined as [2] the presence of one or more characteristic features as follows:

- Fever (oral temperature of 38 ℃ or above, with a shift of 1 ℃ from pre-transfusion value)
- Chills/rigors.

Signs and symptoms:

Headache and nausea may accompany fever, chills, and rigors during or four hours after transfusion without any other underlying conditions, such as a hemolytic transfusion reaction, bacterial contamination, or a bacterial infection. If you have chills or rigors but no fever, you could still have FNHTR.[2]

Allergic reactions and Anaphylaxis:

Depending on the nature and severity of the reaction, an allergic reaction could be anything from minor to fatal.

Signs and symptoms:

Mucocutaneous signs and symptoms of an allergic reaction may appear during or within four hours following transfusion:

Morbilliform rash and itching, Urticaria (hives), locally confined oedema, Lip, tongue, and uvula oedema, Conjunctival oedema, erythema, and periorbital pruritus.[2]

Unfavourable transfusion responses in the lungs: **TACO (transfusion-associated circulatory overload)** and **TRALI (transfusion-related acute lung injury):**

Each of these pulmonary adverse effects is characterised by pulmonary oedema and respiratory discomfort.

Clinical definitions have been given based on their aetiology and clinical spectrum:

- **TACO explanation:**

Three or more of the following requirements must all be present for the condition to exist, and they must all occur during or within 12 hours of the transfusion.[2]

Acute or worsening respiratory compromise: Tachypnoea, shortness of breath, cyanosis, and lower oxygen saturation levels are a few of its symptoms. Clinical signs include crackles on lung auscultation, orthopnea, coughing, a third heart sound, and in more severe cases, pinkish frothy sputum.

Non-invasive test such as an echocardiography or radiographic chest imaging to evaluate the condition of the heart.

The results show that pulmonary oedema from circulatory overload is characterised by alveolar oedema with nodular areas of increased opacity, bilateral Kerley lines, new or worsening pleural effusions, widened vascular pedicles, progressive lobar vessel enlargement, peribronchial cuffing, and/or enlarged cardiac silhouette.

Evidence of anomalies in the cardiovascular system, such as the development of tachycardia, hypertension, widened pulse pressure, jugular venous distension, enlarged cardiac silhouette, and/or peripheral oedema, which cannot be explained by patient's underlying illness.

A positive fluid balance, a favourable response to diuretic therapy such as dialysis or diuretic therapy coupled with clinical improvement, a change in patient's weight during period of transfusion are examples of signs of fluid overload.

For example, a rise in the B type natriuretic peptide level that is Greater than 1.5 times the pretransfusion value and over the reference

range for that age group would be seen as supportive. Serial monitoring of NP levels in the peri-transfusion period may aid in the diagnosis of TACO; however, a normal post-transfusion NP level does not support the TACO diagnosis.

TRALI definition: TRALI is divided into type 1 and 2.[5]

TRALI Type 1:

Patients are categorised as Type 1 if they meet the requirements below and do not have any ARDS risk factors:

a. The following are signs of developing respiratory distress:

1. Acute onset.
2. (P/F less than 300 or SpO2 less than 90% on room air) Hypoxemia.
3. On imaging, there is a definite sign of bilateral pulmonary oedema (e.g., chest radiograph, chest CT, or ultrasound).
4. The absence of left atrial hypertension (LAH) or, if it exists, the finding that it is not the primary factor causing the hypoxemia.

b. Onset during or within 6 hours of transfusion.

c. There is no temporal relationship to another ARDS risk factor.

TRALI type 2 (previously known as possible TRALI):

Patients with ARDS risk factors include those who have direct lung injury from aspiration of gastric contents, pneumonia, inhalational injury, lung contusion, near drowning, pulmonary vasculitis, and indirect lung injury from non-pulmonary sepsis, non- cardiogenic shock, major burns, severe burns, acute pancreatitis, cardiopulmonary bypass, and drug overdose. Additionally, there are those who already have mild ARDS (P/F of 200–300), but whose respiratory condition worsens and is determined to be related to transfusion based on:

- Findings as described in categories a and b of TRALI Type 1; and
- Stable respiratory status in the 12 hrs prior to transfusion.

Transfusion-associated hypotension (TAH):

Hypotension, which is defined as a fall in systolic blood pressure of greater than or equal to 30 mm Hg that occurs during or within an hour of the completion of the transfusion and a drop in systolic blood

pressure less than or equal to 80 mm Hg, characterises this reaction. All other transfusion reactions presenting with hypotension are excluded.[2]

Signs and symptoms:

Hypotension is usually the sole manifestation, but facial flushing and gastrointestinal symptoms may occur.

Transfusion-associated graft-versus-host disease (TA-GvHD)

It is a clinical syndrome characterised by presence of fever, rash, liver dysfunction, diarrhoea, pancytopenia and characteristic histological findings on biopsy occurring 1-6 weeks following transfusion with no other apparent cause.[2]

Post transfusion purpura (PTP):

It is characterised by thrombocytopenia that appears 5–12 days after receiving a cellular blood component transfusion and antibodies directed against the Human Platelet Antigen (HP A) system in the patient.[2]

FNHTRs, or febrile nonhemolytic transfusion reactions, are frequent side effects of the transfusion of allogenic RBCs. Although they frequently happen at the time of transfusion, similar reactions might occur 4-6 hours afterwards. An estimated 0.5–6.8% of all transfused units of non-leuko-reduced RBCs experience febrile responses.[6,7] Leukocytes, or white blood cells, are thought to be a significant contributor to FNHTRs; the rate of WBC-derived pro-inflammatory cytokines rises with storage due to active cytokine synthesis.[8] Human leukocyte antigen (HLA) or WBC-specific antigens on donor WBCs interact with the recipient's cytotoxic antibodies to produce antigen-antibody complexes that bind complement and release endogenous pyrogens.[3] The elimination of the WBCs prior to storage will decrease the quantity of FNHTRs by preventing the build-up of cytokines during storage and by eliminating the antigenic targets for pre-existing anti-WBC antibodies [9] Pre-storage leuko-reduced (Pr-SLR) RBCs have been linked to lower rates of FNHTR compared to post-storage leuko-reduced RBC units, despite the fact that cytokine levels did not alter during storage [10,11] Although it cannot stop the build-up of WBC-

derived cytokines during storage, post-storage WBC reduction has been found to be just as successful in removing WBCs as pre-storage WBC reduction and may even have the extra benefit of removing some activated complement fragments.[3] Leuko-reduced blood units have been demonstrated to diminish leucotropic viruses such cytomegalovirus (CMV), human T cell leukaemia virus, and Epstein-Barr virus transmission as well as FNHTRs, HLA alloimmunization, platelet refractoriness.[12]

Without being leuko-reduced, red blood cells (RBCs) have 10^8–10^9 leukocytes per component.[3]

The current accepted method for leukocyte reduction of RBCs is filtering. WBCs can be reduced by about 4-5 log using leukocyte-reduction filters.[3,13-17] As blood passes through these filters, it comes into contact with a sizable surface area of interlaced synthetic microfibers with pores as small as 4 micrometres.[3] The quantity of leukocytes introduced into the filter, flow rate, pressure, priming, rinsing, temperature, blood viscosity, holding period between blood collection and filtration, deformability of erythrocytes and leukocytes, and plasma content of the cell suspension are just a few variables that can affect filter performance.[11,17]

Leukocyte reduction filters have several advantages, however blood bank employees must be aware that they could potentially cause hemolysis, especially in older RBC units.

In this study, we performed a prospective analysis comparing the frequency of transfusion-related adverse events between leuko-reduced packed RBCs and non-leuko-reduced packed RBCs over the course of a year in a tertiary care hospital.

AIM AND OBJECTIVE

To evaluate transfusion related adverse events due to packed red blood cells (Leuko-reduced PRBCs and Non-Leuko-reduced PRBCs).

REVIEW OF LITERATURE

Access to adequate and safe blood transfusion facilities is integral to any basic health care delivery infrastructure. They are often lifesaving in critically ill patients. On the flipside, blood transfusions are also inherently embedded with risks ranging in severity from minor to life threatening.

Transfusion of blood products is a double-edged sword and should be used judiciously. Improvements in donor screening and transfusion transmissible diseases testing procedures have led to a decrease in the hazards and risks that are associated with transmission of the infectious diseases associated with blood transfusion. However, the risks of non-infectious complications have become more apparent. These non-infectious complications called as transfusion related adverse events (TRAEs), they can either be acute in nature or follow a delayed course.[18] Knowledge of these TRAEs will help us to prevent its occurrence by taking precautionary and adequate measures and ensuring blood safety.

As we discussed earlier, it was whole blood which used to transfuse in case of hematological problems. But this concept of only using the whole blood has changed after the introduction of various blood components such as packed red blood cells, platelet concentrates, plasma & cryoprecipitates. Improvements in donor screening and transfusion transmissible diseases testing procedures have led to a decrease in the hazards and risks that are associated with transmission of the infectious diseases associated with blood transfusion. However, transfusion of blood and blood components are associated with adverse events. More than 90% of adverse reactions to transfusions are associated with the presence of white blood cells in blood components. White blood cells (WBCs or leukocytes) are considered to be an important cause of FNHTRs; the rate of WBC derived pro-inflammatory cytokines increase with storage due to active synthesis of cytokines by these cells.[8] Febrile non hemolytic transfusion reactions are more common complications as compared to

other transfusion adverse events, resulting after transfusion of allogenic packed red blood cells. The removal of the WBCs before storage will both prevent the accumulation of cytokines during storage and will also remove the antigenic targets for preformed anti-WBC, leading to a reduction in the number of FNHTRs.[9]

Removal of leukocytes from transfused blood cellular products was shown to minimize febrile non-hemolytic transfusion reactions, human leukocyte antigen, alloimmunization, platelet refractoriness and also prevents the transmission of leuko-tropic viruses, such as cytomegalovirus, human T-cell leukemia virus, and Epstein Barr virus.[12]

Various studies have supported the evidence of a significant decrease in TRAEs with leuko-reduced packed red blood cells as compared to non- leuko-reduced PRBCs. The reduction of febrile non hemolytic transfusion reactions and other adverse reactions have taken a forefront in usage of Leuko-reduced packed red blood cells.

Following are some studies which have been done to justify the comparison of transfusion reactions in leuko-reduced PRBC's and non-leuko-reduced PRBC's

In study done on transfusion related adverse events on thalassaemic patients in 2014, the transfusion of PRBCs was studied in large cohort of thalassaemic patients and transfusion reactions were correlated with the leuko-reduced status of the blood products used. Out of all reactions, 0.22% reactions occurred in category B (leukoreduction by buffy coat method) and 0.58% in category C (non-leuko-reduced PRBCs) and no reaction noted in category A (leukodepletion by bedside filters). This study was done by Dr AM Shanthala Devi, KG Gaikhonlungpou.[19]

According to a study in 2016, total incidence of Transfusion Reaction was found to be 0.38%, whereas in similar studies by University of Puerto Rico, Auckland Regional Blood centre and North India, incidence was 0.2%, 0.34%, 0.18% and 0.05% respectively. [6,20-23] The overall rate of Transfusion Reactions with non-leuko-reduced PRBCs was 0.54% which is comparable with other studies of non-leuko-

reduced PRBCs.[6,19,24] This study shows rate of Transfusion reactions in Pre-storage leuko-reduced RBCs was 0.13% and in a similar study by King et al.[25] Yazer et al.[26] and Shanthala Devi [19] the rates of TRs were 0.40%, 0.69% and 0.26%.They found a significant difference in the incidence of FNHTRs, that is, 0.05% versus 0.24% in Pr-SLR and non-leuko-reduced RBCs. This study is done by Dr Rajesh k et al.[27]

In another study in the same year 2016 by Dr Riti Tushar Kanti Sinha, Dr Rai P, Dey A; females were more affected than males similar to the study by Sidhu et al.[28] However in a study by, Kumar et al[23] males were more affected than females. An allergic reaction may vary from only fever or urticaria to the presence of wheezing and angioedema. Among non-hemolytic transfusion reactions allergic reactions occur most frequently. In that study, 5 out of the 11 cases of allergic reaction had hyper-eosinophilia. Other than allergies, dermatological disorders, parasitic infections, bacterial infections, collagen vascular diseases, side effects of medications, and myeloproliferative diseases can also lead to an increase in eosinophil count. These conditions need to be ruled out. Allergic reactions to unknown components in donor's blood are common. Mast cell stimulation, immunologically active food allergens in donor plasma or less common antibodies from an allergic donor can act as triggering events in allergic reactions. These usually present as urticaria or erythematous lesions and respond well to antihistamine therapy. Anaphylactic reactions were categorized as those having systemic symptoms including hypotension and/or loss of consciousness and/or shock.[22] In this study, the highest incidence of transfusion reactions was found to be allergic in nature. The overall incidence of allergic reactions was found to be 0.19% in this study. In all these cases, transfusion of whole blood was implicated. Sidhu et al., [28] Kumar et al. [23] and Domen and Hoeltge [29] found an incidence of allergic reactions 0.11%, 0.028%, and 0.02%, respectively, in their studies respectively.

In a study by Dr K. Mahesh Kumar, Dr Chintakindi Sravan, Dr Sudhir Kumar Vujhini in 2017; it was found that by using leuko-reduced filters,

one can achieve four log reduction of the total leukocyte count. When the unit of blood (approximately 450 ml) is collected there will be 4,000 to 11,000 WBCs /cu.mm, sometimes still higher count. Even after the blood component processing, 90% of these white blood cells remain with the RBCs, 8% of these white blood cells remain with the platelets as mononuclear cells; and 2% of cells remain in a unit of fresh frozen plasma. Leuko-reduction is done to reduce the number of white blood cells in the blood unit.[30]

Indications of Leukoreduction are:

1. Reduction of non-hemolytic transfusion reactions,
2. Reduction of HLA alloimmunization that may lead to patients becoming refractory to platelet transfusions e.g., patients requiring long term platelet therapy as in Aplastic anaemia and MDS,
3. Reduction of CMV transmission e.g., in patients awaiting organ transplantation,
4. Reduction in the risk of Yersinia enterocolitica contamination of RBC,
5. Possible reduction of prion disease,
6. Reduction in the incidence of transfusion associated Graft Versus Host Disease (TA-GVHD).[30]

In a study, done in 2018 by chin Chun Chang, Tai Chen lee, Ming Jang su, Hsiu Chen Lin, fang-Yi Cheng, Yi-ting Chen et al results indicated that prevalence of TAARs was significantly reduced in the transfusions of pre-Leuko-reduced packed red blood cells when compared with that in the transfusions of post-Leuko-reduced. Particularly, the prevalence of FNHTRs was significantly reduced in the pre-leuko-reduction RBC transfusions when compared with that in the transfusion of post-Leukoreduction RBCs and the prevalence of allergy reactions was markedly reduced in the pre-LR PRBCs transfusions. In vitro evaluation of cytokines in the pre- and post-LR blood components revealed that IL-1β, IL-8 and RANTES levels were significantly elevated in the post leuko-reduced red blood cells. Similarly, IL-1β, IL-6 and IL-8 levels were significantly elevated in the post-LR-PRBC's when compared with those in the pre LR-PRBCs during the storage. These

findings suggested that pre-storage leukoreduction had a diminishing effect on the development of TAARs, which could be associated with less accumulation of cytokines in the stored blood components. this study done by dr Chin-Chun Chang et al.[31]

In a study by Prasun Bhattacharya et al[22], fever was observed in 25 patients out of 43 characterized as FNHTR.

In one study There were 380 platelet transfusions to 30 patients. The frequency of reactions was 25.8 percent (48/186) in the transfusions of post-storage WBC-reduced platelets and 17.0 percent (33/194) in the transfusions of plasma-depleted platelets ($p<0.008$). The severity of the reaction was graded by the patient. Severe reactions occurred more frequently in case of post-storage WBC-reduced platelets than with plasma-depleted platelets: 33.4% versus 18.2%, respectively. Regression analysis identified interleukin 6 as the most significant in its correlation with the risk of reaction.[32]

With the concept of universal leukoreduction there is risk reduction for FNHTR. The most common quoted rate for FNHTR is 0.5-1% [33] for the general populations of patients with red cell (Whole blood/PRBCS) transfusion.

In other studies, it varies from 0.08% to 6.8%.[7,34] A comparative study on incidence of FNHTR in leuko-reduced vs. non leuko-reduced blood components showed that the incidence is 0.12% in non-leuko-reduced and 0.08% in pre-storage leuko-reduced blood.[11] In this study, with transfusion of the non-leuko-reduced packed red cells has shown the overall risks for FNHTR to be 0.114% (43 out of 37,550) which is comparable to the reported data of non-leuko-reduced blood components.[18] Definitions of allergic reactions vary greatly. Moore et al, [35] reported a 3% rate of mild allergic reactions. This mild allergic reaction was defined as hive or localized urticaria. Incidence in other studies varies from 0.2% to 3%.[31-33,35] To avoid adverse reactions up to some extent, removal of leukocytes from the blood unit is recommended by various methods. After the removal of the leukocytes, the unit is labelled as leuko-reduced packed red blood cell.

Table no. 2- Comparison of FNHTRs in Pr-SLR and non-leuko-reduced RBCs in various studies

Author	Pr-SLR RBC %	Non-leuko-reduced PRBCS %
Shantala Devi and Gaikhonlungpou [19]	0.58	0.23
Bhattacharya et al [22]	0.19	0.33
Kumar et al [23]	0.1	0.34

Transfusion related adverse events can either be acute in nature or follow a delayed course.

The adverse reactions include [4] ABO hemolytic reactions, allergic reactions, anaphylactic reactions, bacterial contamination, febrile non hemolytic transfusion reactions (FNHTR), HLA alloimmunization, graft versus host disease, transfusion related acute lung injury, transfusion related immunomodulation, transfusion of leuko-tropic viruses, such as cytomegalovirus (CMV), Epstein Barr virus (EBV) and human T CELL Lymphotropic virus (HTLV) etc.

Through this study, the extent, incidence and severity of transfusion reactions occurring with leuko-reduced and non-leuko-reduced blood will be studied. This study was useful in preventing transfusion related adverse events. Thus, this study helped us in providing information regarding blood safety. The main objective of this study was to track the adverse events associated with transfusion of packed red blood cells and to help identify trends, recommend best practices and interventions require to improve patient care and safety

Multi transfused thalassemia patients, oncology patients, patients undergoing surgeries, Patients in Intensive Care Units, Cardiovascular patients are prone to transfusions related complications as they required comparatively Multiple Transfusions. Study of these reactions and correlating them with leukoreduction of the transfused packed red blood cells (PRBCs) reduces transfusion complications due to the transfused leukocytes.

Classification of transfusion reactions:

Transfusion reactions are usually classified based on time of onset and the mechanisms (immune or non-immune) leading to the reaction. Reactions occurring within 24 hours of transfusion are termed acute, rest are delayed.

Acute transfusion reactions

a. Immune-mediated

- Hemolytic transfusion reactions (HTR)
- Febrile non-hemolytic transfusion reactions (FNHTR)
- Allergic reactions
- Anaphylaxis
- Transfusion related acute lung injury (TRALI)

b. non-Immune mediated

- Transfusion associated circulatory overload (TACO)
- Transfusion associated dyspnoea (TAD)
- Transfusion associated hypotension (TAH)
- Metabolic complications
- Transfusion transmitted bacterial infections (TTBI)

Delayed transfusion reactions

c. Immune mediated

- Delayed hemolytic transfusion reactions (DHTR)
- Delayed serological transfusion reaction (DSTR)
- Post-transfusion purpura (PTP)
- Transfusion associated graft vs. host disease (TA-GvHD)
- Transfusion related immunomodulation (TRIM)

d. non-Immune mediated

- Transfusion transmitted viral infection
- Transfusion transmitted malaria
- Transfusion transmitted prion disease
- Iron overload [4]

Hemolytic transfusion reactions

Definition:

A hemolytic transfusion reaction is one in which symptoms and clinical or laboratory signs of increased red cell destruction are produced by transfusion. Hemolysis can occur intravascularly or extra vascularly and can be immediate (acute) or delayed.[2] It is usually a result of red blood cell (RBC) transfusion, however, it may also result from transfusion of plasma-containing blood components, such as fresh frozen plasma (FFP) or platelet concentrates (PC) containing red cell antibodies.

Acute hemolytic transfusion reaction (AHTR):

It is characterised by the onset of clinical or laboratory features of hemolysis within 24 hours of a transfusion.

Delayed hemolytic transfusion reaction (DHTR):

It is characterised by clinical or laboratory features of hemolysis which usually manifest between 24 hours and 28 days after a transfusion.

Mechanism:

AHTR usually occurs when the recipient has pre-existing antibodies against the transfused RBCs in the form of IgM antibodies and hemolytic IgG antibodies against the A or B antigen, or the antibodies against RBC's that can be alloantibodies or autoantibodies. It may also occur due to non-immunological factors like malfunction of a pump, blood warmer, use of hypotonic solutions, etc. Usually, the IgM antibody in the recipient binds to foreign RBC antigen resulting in complement activation and formation of membrane attack complex (MAC), which leads to intravascular lysis of RBC and release of free hemoglobin (hemoglobinemia) in the circulation and leads to acute tubular necrosis and renal failure. The early products (C3a, C5a: anaphylatoxins) of complement cascade cause activation of mast cells, leucocytes, monocytes and endothelium and subsequent release of cytokines and chemokines (TNF-α, IL-1, Il-6, IL-8), leading to increased capillary permeability, endothelial damage, vasodilatation and subsequent clinical manifestations of systemic inflammatory response syndrome. In DHTR, predominantly the immunoglobulin (IgG) and

complement (C3b) coated cells interact with phagocytes in the liver and spleen, resulting in clearance of RBCs and activation of phagocytes, thus causing extravascular hemolysis, which also cause a rise in bilirubin levels. The peripheral blood film then shows spherocytes and micro-spherocytes. DHTR is more common with non-ABO alloantibodies and is frequently the outcome of an anamnestic (secondary) immune response in previously sensitized patients.

Signs and symptoms:

- Fever
- Chills/rigors
- Facial flushing
- Chest pain
- Abdominal pain
- Back/flank pain
- Nausea/vomiting
- Diarrhoea
- Hypotension
- Pallor
- Jaundice
- Oligo/anuria
- Diffuse bleeding
- Dark urine [4]

Differential diagnosis [36]

- Alloantibody-induced hemolysis
- Delayed serologic transfusion reaction
- Autoimmune hemolytic anaemia
- Cold hemagglutinin disease
- Non-immune hemolysis caused by

✓ Incompatible fluids
✓ Improper storage
✓ Malfunctioning blood warmers
✓ Small needles
✓ Bacterial contamination

Febrile non-hemolytic transfusion reactions (FNHTR)

Definition:

FNHTR is defined as [2] the presence of one or more of:

- Fever (≥38 ºC oral or equivalent and a change of ≥1 0 C from pre-transfusion value).
- Chills/rigors.

Mechanism:

Human leucocyte antigen (HLA), granulocyte, and platelet-specific antibodies have been implicated in the pathogenesis of FNHTRs. The recipient's antibodies, reacting with transfused antigens, release cytokines (e.g., interleukin 1) that can cause fever.[37]

Signs and symptoms:

-Fever, chills and rigors may be accompanied by headache and nausea during or within four hours following transfusion without any other cause such as hemolytic transfusion reaction,

-Bacterial contamination or underlying condition. FNHTR could be present even in the absence of fever (if chills or rigors without fever) [2]

Differential diagnosis:

• Hemolytic transfusion reactions

• Sepsis

• Transfusion related acute lung injury.

Allergic reactions and anaphylaxis

Definition:

Allergic reaction may range from minor to life-threatening depending on the course and outcome of the reaction.

Mechanism:

An allergic reaction usually occurs due to hypersensitivity to an allergen and preformed IgE antibodies in the recipient. Mast cell activation (Type I hypersensitivity) occurs which results in degranulation and release of allergic mediators. Secondary mediators, including cytokines and lipid mediators, are also generated and

released. IgA deficiency and/or anti-IgA in the recipient may be associated with severe allergic reactions.[4]

Signs and symptoms:

An allergic reaction may present with mucocutaneous signs and symptoms occurring during or within 4 hours of transfusion:

- Morbilliform rash with pruritus
- Urticaria (hives)
- Localized angioedema
- Oedema of lips, tongue and uvula
- Periorbital pruritus, erythema and oedema
- Conjunctival oedema

An allergic reaction can also involve respiratory and/or cardiovascular systems and present like an anaphylactic reaction when, in addition to mucocutaneous systems, airway compromise or severe hypotension requires vasopressor treatment (or associated symptoms like hypotonia, syncope). The respiratory signs and symptoms may be laryngeal (tightness in the throat, dysphagia, dysphonia, hoarseness, stridor) or pulmonary (dyspnoea, cough, wheezing/bronchospasm, hypoxemia). Such a reaction usually occurs during or very shortly after transfusion.[2]

Pulmonary adverse transfusion reactions

Transfusion-associated circulatory overload (TACO) and transfusion-related acute lung injury (TRALI):

Both these pulmonary adverse events are characterized by respiratory distress and pulmonary oedema. However, separate clinical definitions have been assigned to both these conditions depending on their pathophysiology and clinical spectrum.

• **TACO definition**: It is characterized by the presence of a total of 3 or more of the following criteria occurring during or upto 12 hours after transfusion.[1]

- Acute or worsening respiratory compromise: It is manifested by tachypnoea, shortness of breath, cyanosis and decreased oxygen saturation values. The clinical finding could include crackles on lung

auscultation, orthopnoea, cough, a third heart sound and pinkish frothy sputum in severe cases.

- Radiographic chest imaging and/or other non-invasive assessment of cardiac function, e.g., echocardiogram. The findings suggest pulmonary oedema from circulatory overload includes the presence of new or worsening pleural effusions, widened vascular pedicle, progressive lobar vessel enlargement, peribranchial cuffing, bilateral Kerley lines, alveolar oedema with nodular areas of increased opacity and/or cardiac silhouette enlargement.

- Evidence of cardiovascular system changes not explained by the patient's underlying medical condition, including the development of tachycardia, hypertension, widened pulse pressure, jugular venous distension, enlarged cardiac silhouette and/or peripheral oedema.

Evidence of fluid overload including any of the following: a positive fluid balance; response to diuretic therapy, e.g., from diuretic therapy or dialysis combined with clinical improvement; and change in the patient's weight in the peri-transfusion period.

- Supportive result of a relevant biomarker, e.g., an increase of b type natriuretic peptide level (e.g., BNP or NT-pro BNP) above the age group-specific reference range and greater than 1.5 times the pre-transfusion value. A normal post-transfusion NP level is not consistent with a diagnosis of TACO; serial testing of NP levels in the peri-transfusion period may help identify TACO.

• **TRALI definition**:

TRALI can be defined as type 1 and type 2 as following [5]

TRALI Type 1 –

1) Patients who have no risk factors for ARDS and meet the following criteria:
    a. The development of respiratory distress is characterized by
        - Acute onset
        - Hypoxaemia (P/F ≤ 300 or SpO2 < 90% on room air)
        - Clear evidence of bilateral pulmonary oedema on imaging (e.g., chest radiograph, chest CT, or ultrasound)

- No evidence of left atrial hypertension (LAH) or, if LAH is present, it is not the main contributor to hypoxaemia

b. Onset during or within 6 hours of transfusion

c. No temporal relationship to an alternative risk factor for ARDS.

TRALI type 2

Patients who have risk factors for ARDS (but not been diagnosed with ARDS) like direct lung injury due to aspiration of gastric contents, pneumonia, inhalational injury, lung contusion, near drowning, pulmonary vasculitis and indirect lung injury due to non-pulmonary sepsis, non-cardiogenic shock, major burns, severe burns, acute pancreatitis, cardiopulmonary bypass and drug overdose or who have existing mild ARDS (P/F of 200-300), but their respiratory status deteriorates and is judged to be due to transfusion based on:

i. Findings as described in categories a and b of TRALI Type 1, and

ii. Stable respiratory status in the 12 hrs before transfusion.

Mechanism:

Acute respiratory distress in TACO is due to cardiogenic oedema, which develops due to circulatory overload and increases central venous pressure. It causes pulmonary vascular congestion and decreased lung compliance presenting as dyspnoea, hypertension and tachycardia. In severe cases, it may even lead to cardiac failure. However, in TRALI, the pulmonary oedema is non-cardiogenic, which occurs as a result of capillary endothelial leak leading to the exudative fluid passing from pulmonary vessels to lung alveoli, causing dyspnoea.[4]

Transfusion-associated dyspnoea (TAD):

It is characterised by respiratory distress within 24 hours of transfusion that does not meet the criteria of TRALI, TACO, or allergic reaction.[2] Respiratory distress should be the most prominent clinical feature and should not be explained by the patient's underlying condition or any other known cause.

The pathophysiology of TAD is not clear as it is intermediate between TACO and TRALI. It is self-limiting and may require supportive management in few cases.

Transfusion-associated hypotension (TAH):

This reaction is characterized by hypotension defined as a drop in systolic blood pressure of more than or equal to 30 mm Hg occurring during or within one hour of completing transfusion and systolic blood pressure less than or equal to 80 mm Hg and all other transfusion reactions presenting with hypotension are excluded.[2]

Mechanism [38]

Exposure to filter surfaces mainly negatively charged, which mimics sub-endothelium in bedside leucocyte filters, leads to activation of factor XII. It converts pre-kallikrein to kallikrein which cleaves kininogen to bradykinin. This bradykinin causes vasodilation causing hypotension. Stagnation of bradykinin catabolism in patients on ACE inhibitors predispose them to hypotensive reactions. Hypotensive reactions are also seen without bedside leuco-reduction filters. In these cases, patient's underlying condition and any extra corporeal circuits have been implicated in hypotensive reactions.

Signs and symptoms:

Hypotension is usually the sole manifestation, but facial flushing and gastrointestinal symptoms may occur.

Differential diagnosis:

- ✓ HTR
- ✓ allergic,
- ✓ anaphylaxis,
- ✓ TTBI and TRALI should be excluded as these reactions can also present with hypotension.

Post transfusion purpura (PTP):

It is characterized by thrombocytopenia arising 5-12 days following transfusion of cellular blood components with findings of antibodies in the patient-directed against the Human Platelet Antigen (HPA) system.[2]

Mechanism:

Antibodies to HPA-1a and HPA-1b (and sometimes HPA-1b, -2b, -3a, -3b, -4b, -5a, -5b, and -15b) result in destruction of both transfused and host platelets (PLTs), leading to severe thrombocytopenia (10000/microlitre) These antibodies result from recipient's prior exposure to PLT antigens through pregnancy (85-95% of cases) or transfusion. PTP can be triggered by transfusion of any blood components- PRBCs, PLTs, plasma-containing PLT antigens or secondary to passive transfer of antibodies.[39] The mechanism of destruction of the patient's own HPA-1a-negative platelets remains uncertain.[36]

Signs and symptoms:

Mucocutaneous bleeding (wet purpura, petechiae, epistaxis, gastrointestinal, and urinary tract) is common. Mortality rates could be up to 16%, due to intracranial hemorrhage [30,39] Although, thrombocytopenia usually resolves spontaneously within a few weeks, it may be delayed by up to four months or more.[40]

Differential diagnosis:

Other causes of thrombocytopenia, such as

- Autoimmune thrombocytopenia,
- Thrombotic thrombocytopenic purpura,
- Heparin-induced thrombocytopenia (HIT),
- Disseminated intravascular coagulation (DIC) and
- Drug-induced thrombocytopenia should be ruled out.

However, in PTP, the patients usually have normal platelet counts previously and are asymptomatic [39]

Transfusion-associated graft-versus-host disease (TA-GvHD):

In a large compilation of TA-GvHD cases by Kopolovic et al, [41] nearly all cases were attribute to whole blood and PRBC's. Among 84 cases, 60 belongs to D=0 category (no donor antigen foreign to recipient) and remaining 24 were D= 1 (donor antigen disparity)

It is a clinical syndrome characterised by symptoms of fever, rash, liver dysfunction, diarrhoea, pancytopenia and characteristic histological

findings on biopsy occurring 1-6 weeks following transfusion with no other apparent cause.[42]

Mechanism:

The major risk factors for TA-GvHD are the degree of recipient's immunodeficiency, the number of viable T-lymphocytes in the transfused blood component and the degree of genetic diversity in the population.[25] In an immunocompetent recipient, when there is a recognition of 'nonself' HLA of the transfused donor lymphocytes by the host immune system, it usually leads to attack and death of the donor lymphocytes contained in the transfused blood component, thus preventing engraftment and proliferation.[40] In circumstances when the blood donor is homozygous for the HLA antigens for which the recipient is heterozygous (one-way haplotype match), [36] the recipient's immune system does not recognize the HLA-homozygous transfused donor lymphocytes as 'non-self'. In contrast, the transfused lymphocytes are able to recognize the host cells as 'non-self' and are able to mount an immunologic attack on the host.[43]

Signs and symptoms:

- These include fever,
- Erythematous Rash
- Pancytopenia,
- Bone marrow aplasia
- Diarrhoea, and
- Deranged liver function tests.

The clinical manifestations occur 1-6 weeks following transfusion [2] All the cellular blood products including whole blood, packed red blood cells (PRBCs), platelets and granulocytes have been implicated but not the plasma products, or frozen-deglycerolised RBCs due to insufficient number of viable donor lymphocytes in these products.[36]

Differential diagnosis:

Other clinical conditions like drug reactions and viral illness may have similar presentation.[43]

Efficacy of leucocyte filters

According to the various trials and observations, the leucocyte filters currently available are capable of providing the desired level of leucodepletion. Present day filters provide a minimum of 4 log depletion of white blood cells and many filters are commercially available with various brand names.[44,45]

LEUKOREDUCTION:

Leukoreduction decreases the incidence of adverse events by filteration of leucocytes in PRBCs. Current leukocyte reduction filters are designed so that blood is distributed over a large surface area of the filter, the volume of blood retained by the filter is minimal, and the filter fits tightly enough with the housing so that blood entering the device cannot bypass the filtration media.[14] The leukocyte reduction filter is designed so that the pore size of the filter media is large enough to allow passage of the deformable red blood cells and platelets, but small enough to impede passage of the more rigid leukocytes.[14] To achieve the small pore size required, the filtration media within the housing consists of nonwoven webs of synthetic microfibers with a diameter of 0.3-3.0 micrometre.[14] Synthetics such as cellulose acetate or polyester need to be used, since natural fibers do not exist at diameters that are this small.[14,46,47] These fibers are interlaced in a series of layers from coarse to fine so that at the upstream end the pore size is large, but as blood passes through the layers of the filter, the pore size decreases to 4 micrometre.[14,46] Variables which may affect the efficiency of filtration include charge of the filter fibers and biologic forces (eg, leukocytes adhere to activated platelets, which adhere to the filter fibers, increasing the efficiency of the filtration.[14]

Evaluation of transfusion related adverse events:

A standard Transfusion related adverse events investigation protocol was followed: All recognized adverse events were reported to the blood bank on a standard reporting form. The clinical information included the patient's pre and post transfusion vital signs and other symptoms noted during the reaction. Further consultation with the ward, staff, patient and chart reviews was performed to resolve ambiguities. The

remaining blood component and a post transfusion blood sample from the patient was sent to the blood bank where a clerical check was performed in parallel with a DAT on the pre and post transfusion sample. Visual inspection of the plasma component of the post transfusion sample was performed for evidence of hemolysis. At the discretion of the blood bank consultant, bacterial cultures of the remaining segments, bag, and patient may be performed. Once the investigation was complete, results were reviewed. Reactions were classified in accordance with the standards and recognized definitions by American association of blood banks.[39]

At the end of this study, we will be able to tell the efficacy of various leukoreduction techniques and their effect on the transfusion related adverse events.

MATERIALS AND METHODS

Patients were stratified by type of the blood component and date of transfusion related adverse events and divided into two groups:

1. Patients who received allogeneic pre-storage Leuko-reduced and post storage Leuko-reduced red blood cells. Leuko-reduced packed red blood cells with inline filters provides 3 log reduction by using Sepacell RC pure filter (99.9%) and bedside filters BPF4 (Paul medical) provides the same amount of leukoreduction.
2. Allogenic non-leuko-reduced red blood cells. Non-leuko-reduced packed cells provides log 1 (90%) reduction by centrifugation and removal of the buffy coat.

Sample Collection

All the transfusion reactions related to PRBCs transfusion were evaluated.

Sample size:

All those patients who were transfused with leuko-reduced and non-leuko-reduced packed red blood cells, reported to have transfusion related adverse events during or after the transfusion.

Source of Data:

All the transfusion related adverse events related to PRBCs as follows:

1. Patients who received allogenic Pre-storage leuko-reduced and post storage leuko-reduced red blood cells.
2. Allogenic non-leuko-reduced packed red blood cells.

Methods of Collection of Data

Inclusion criteria:

Patients requiring Multiple transfusions:

- Thalassemia
- Oncology
- ICU’s
- Heart Patients
- Surgery Patients

Exclusion Criteria:

Transfusion related adverse events from components other than packed Red Blood Cells:

- Platelets concentrate,
- Fresh frozen plasma,
- Single donor platelets apheresis,
- Single donor plasma apheresis,
- Cryoprecipitates and
- Whole blood.

Details of Investigations:

I. ABO Grouping by Column Agglutination Technique
II. Rh (D) by Column Agglutination Technique
III. Compatibility Testing by Column Agglutination Technique
IV. Antibody Screening and Identification by Column Agglutination Technique
V. DAT by Column Agglutination Technique.
VI. Urine Sample for Free Hb.
VII. Blood Bag Culture by Bacteraemia Test

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OBSERVATIONS AND RESULTS

During the study period, 23842 units of total packed red cells units were transfused to patients admitted in various clinical specialties.

Out of 23842 units transfused, Packed red blood cells-14383 Leuko-reduced packed red blood cells- 9459

79 patients (0.3%) had transfusion related adverse events during or after transfusion within 24 hours and no delayed Transfusion related adverse events were reported.

Table 3: number and % age of transfusion related adverse events in present study

Total number of PRBCs Transfused	No. of Transfusion Related adverse events.	%Age
23842	79	0.3%

These Transfusion related adverse events were categorized on the basis of clinical features, compatibility tests, Direct antiglobulin test, Indirect antiglobulin test, DAT panel, Antibody Screening and Antibody Identification tests.

Demographic Details:

(1) AGE

(2) SEX

(3) BLOOD GROUP

(4) TYPE OF BAG

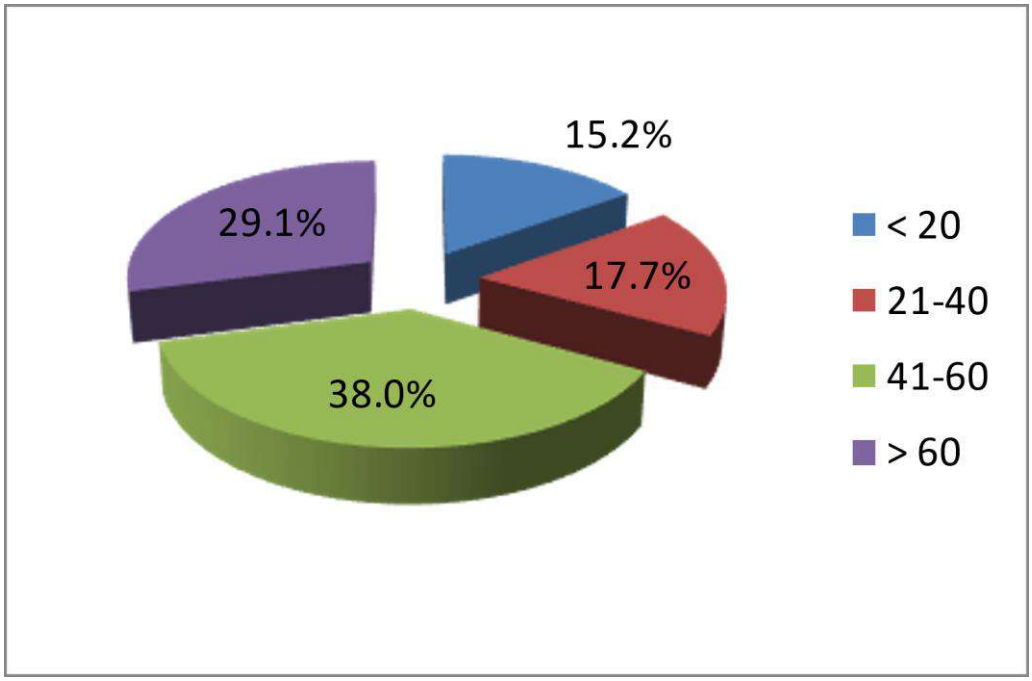
(5) LOCATION

Age distribution:

Table 4: Number and %age of Age distribution among transfusion related adverse events

AGE GROUP	No. of cases	Percentage
< 20	12	15.2%
21-40	14	17.7%
41-60	30	38.0%
> 60	23	29.1%
Total	79	100.0%

Figure 1: %age of different age groups involved in TRAEs



In this study, out of 79 cases,

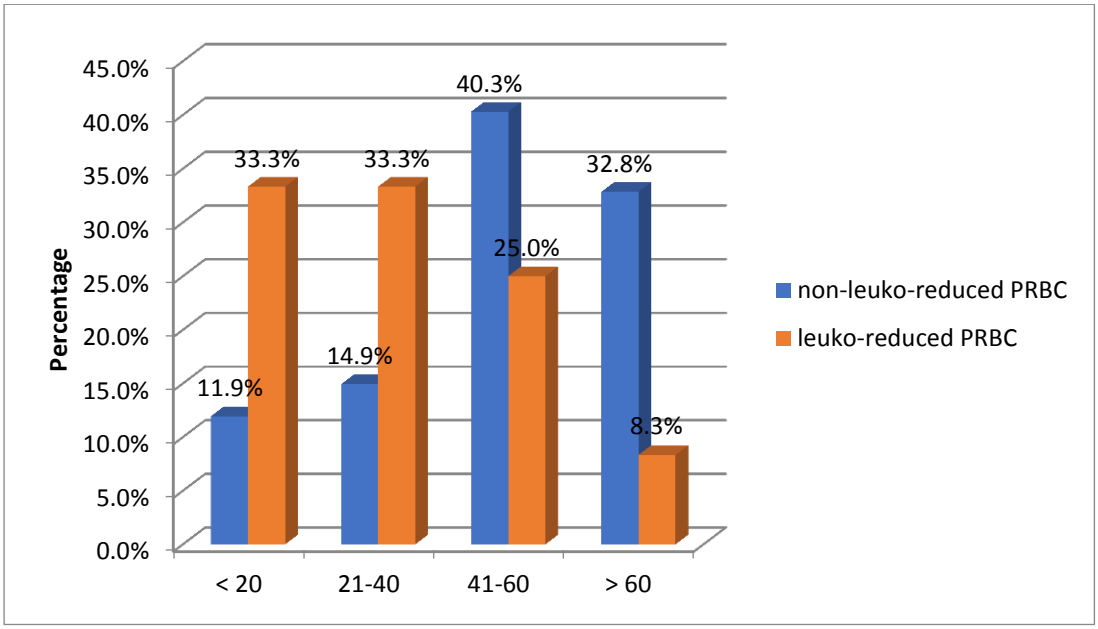
- There were 15.2% (n=12) cases from age group less than 20 years of age.
- 17.7%(n=14) cases in 21-40 years age group.
- 38% (n=30) cases in 41-60 age group and
- 29.1%(n=23) cases in more than 60 years age group.

Most adverse events were from age group 41-60 years of age.

Table 5: Number and %age of distribution of TRAEs among different age groups based on type of PRBCs unit transfused

	TYPE OF UNIT	Non-leuko-reduced PRBCs		Leuko-reduced PRBCs		chi-square value	p-value
		No. of cases	%age	No. of cases	%age		
AGE GROUP	< 20	8	11.9%	4	33.3%	7.738	0.052
	21-40	10	14.9%	4	33.3%		
	41-60	27	40.3%	3	25.0%		
	> 60	22	32.8%	1	8.3%		
Total		67	100.0%	12	100.0%		

Figure 2: %age of distribution of TRAEs among different age-groups based on type of PRBCs unit transfused



In case of non-leuko-reduced PRBCs:

- 11.9% (n=8) were from age <20years.
- 14.9%(n=10) from 21-40 age group
- 40.3%(n=27) were from 41-60 age group,
- 32.8%(n=22) from >60 age group.

Most cases were from age group 41-60 years.

while in case of leuko-reduced PRBCs

- 33.3% (n=4) were from age <20years.
- 33.3%(n=4) from 21-40 age group
- 25.0%(n=3) were from 41-60 age group,
- 8.3%(n=1) from >60 age group

most reactions (33.3%) were from Age-group <20 and 21-40 each.

Chi square value is 7.738

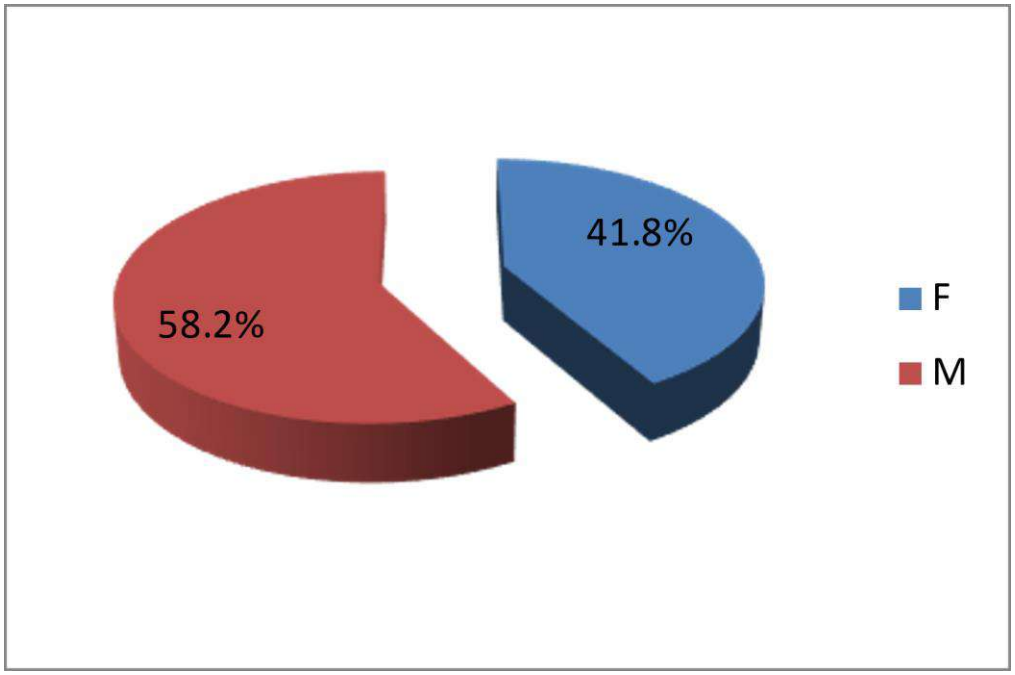
p-value .052 which is insignificant

Gender Distribution:

Table 6: Distribution of number and %age of TRAE's on basis of gender

SEX	No. of cases	Percentage
F	33	41.8%
M	46	58.2%
Total	79	100.0%

Figure 3: **Distribution of %age of TRAE's on basis of gender**

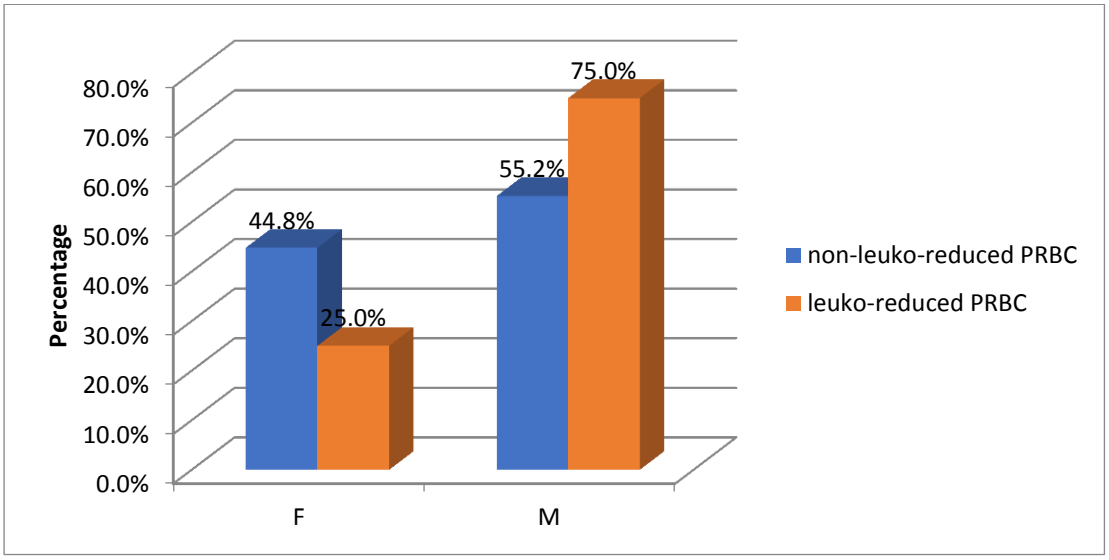


Out of 79 cases, 41.8% (n=33) were females and 58.2% (n=46) were males. Most cases were from male population.

Table 7: Number and %age of distribution of TRAEs among genders groups based on type of PRBCs unit transfused

	TYPE OF UNIT	Non-leuko-reduced PRBCs		Leuko-reduced PRBCs		Total	chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
SEX	F	30	44.8%	3	25.0%	33	1.636	0.201
	M	37	55.2%	9	75.0%	46		
Total		67	100.0%	12	100.0%	79		

Figure 4: %age of distribution of TRAEs among genders groups based on type of PRBCs unit transfused



In case of non-leuko-reduced PRBCs,

- 55.2%(n=37) were Males.
- 44.8%(n=30) were females.

In case of Leuko-reduced PRBCs

- 25%(n=3) were Females
- 75%(n=9) were Males

Frequency of Males more than Females in both non-leuko-reduced PRBCs (55.2%) and Leuko-reduced PRBCs (75%).

Chi square value is 1.636

p-value .201 which is insignificant.

Blood grouping distribution of patients

Table 8: Number and %age of cases on the basis of ABO and RH Blood groups

BLOOD GROUPING OF PATIENT	No. of cases	Percentage
A+	14	17.7%
AB+	11	13.9%
B+	34	43.0%
O+	15	18.9%
A-	0	0%
AB-	0	0%
B-	2	2.5%
O-	3	3.7%
Total	79	100.0%

Out of 79 cases,

- 17.7%(n=14) belongs to group A+,
- 13.9%(n=11) belongs to AB+,
- 43.0%(n=34) belongs to B+ group,
- 18.9%(n=15) belongs to O+ group.
- 2.5%(n=2) are B- group.
- while 3.7% (n=3) belongs to O- group.

Table 9: Number and %age of cases on the basis of ABO and RH Blood groups among different type of PRBCs unit transfused.

	TYPE OF UNIT	Non-leuko-reduced PRBCs		leuko-reduced PRBCs		Total
		No. of cases	%Age	No. of cases	%Age	
BLOOD GROUPING OF PATIENT	A+	13	19.4%	1	8.3%	14
	AB+	10	14.9%	1	8.3%	11
	B+	29	43.2%	5	41.7%	36
	O+	12	17.9%	3	25%	18
	A-	0	0%	0	0%	0
	AB-	0	0%	0	0%	0
	B-	2	2.9%	0	0%	2
	O-	1	1.4%	2	16%	3
Total		67	100.0%	12	100.0%	79

In case of non-leuko-reduced PRBCs,

- cases from A+ group were 19.4%(n=13),
- cases from AB+ were 14.9%(n=10),
- cases from B+ were 43.2% (n= 29),
- cases from O+ were 17.9%(n=12),
- in case of Blood group B- were 2.9%(n=2),
- cases from O- were 1.4% (n=1).

while in case of Leuko-reduced PRBCs transfusion related adverse events from

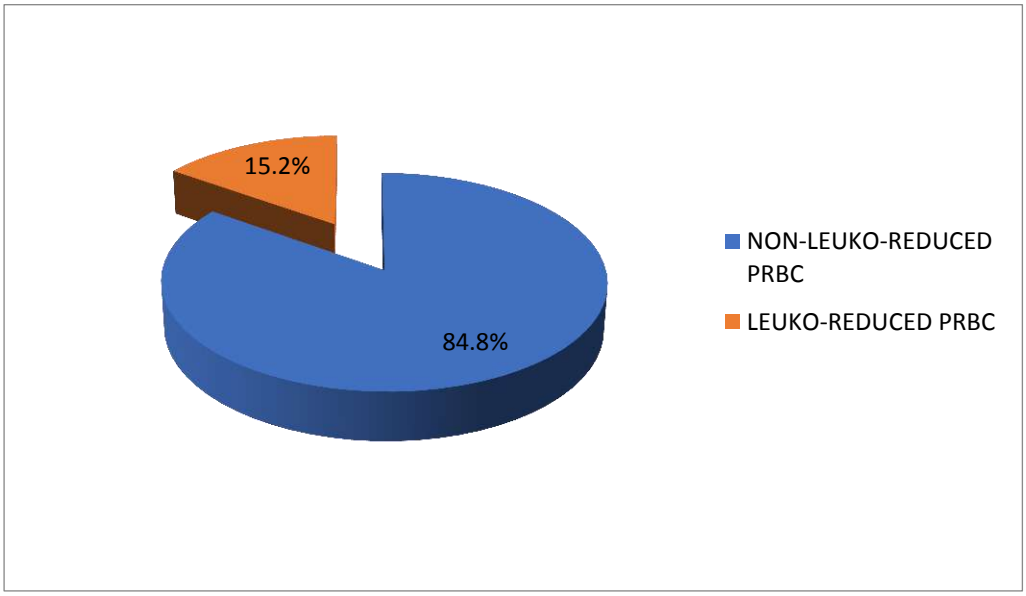
- A+ group were 8.3%(n=1),
- cases from AB+ were also 8.3%(n=1),
- cases from B+ 41.7%(n=5),
- cases from O+ were 25% (n=3) and
- from O- were 16% (n=2).

Type of unit transfused:

Table 10: Number and %age of Transfusion related adverse events on the basis of type of unit transfused

TYPE OF UNIT	No. of cases	Percentage
Non-leuko-reduced PRBCs	67	84.8%
leuko-reduced PRBCs	12	15.2%
Total	79	100.0%

Figure 5: %age of Transfusion related adverse events on the basis of type of unit transfused



Out of 79 cases,

- 84.8% reactions were reported from non-leuko-reduced PRBCs and
- 15.2% from Leuko-reduced PRBCs

Table 11: Number and %age of Transfusion related adverse events on the basis of type of unit transfused among total transfusion

TYPE OF UNIT	Total	No. of cases	Percentage
Non-leuko-reduced PRBCs	14383	67	0.5%
Leuko-reduced PRBCs	9459	12	0.1%
Total	23842	79	0.3%

Total reactions were 79 (.3%) out of 23842, units transfused.

- Out of 14383, 67(.5%) cases were from non-leuko-reduced PRBCs,
- Out of 9459, 12 (0.1%) cases were from leuko-reduced PRBCs.

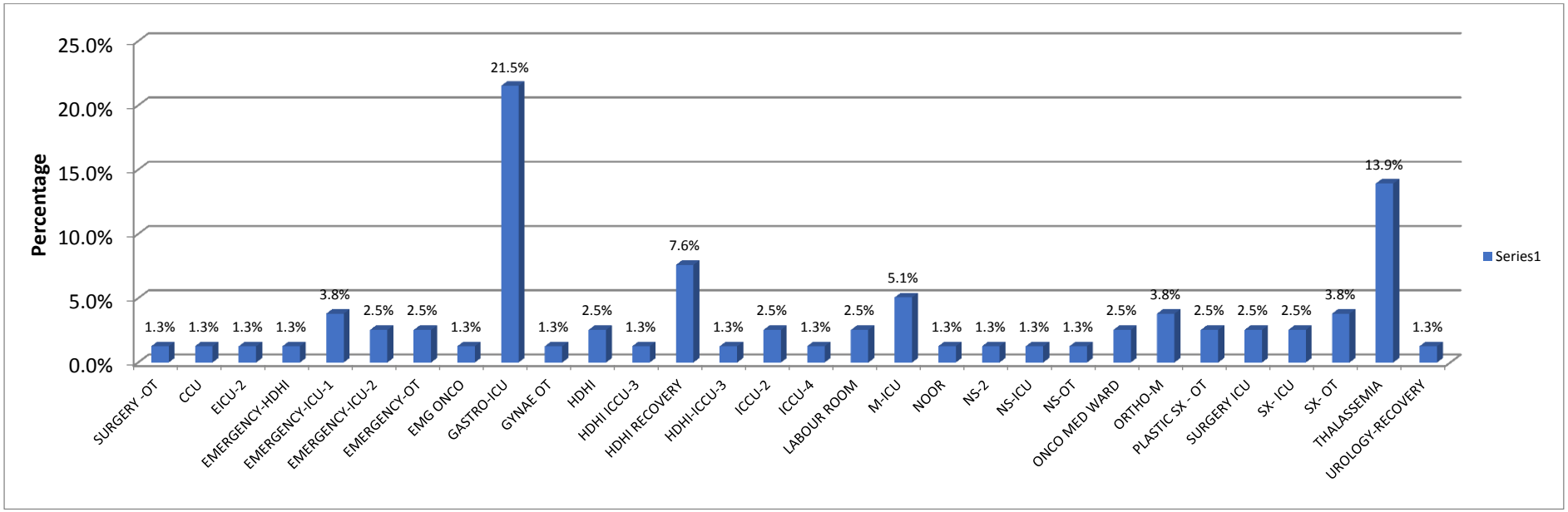
Relative frequency of department reporting Acute transfusion Adverse Events.

Table 12: Number and %age of TRAEs reporting from different departments

PLACE OF TRANFUSION	No. of cases	Percentage
GASTRO-ICU	17	21.5%
THALASSEMIA	11	13.9%
HDHI RECOVERY	6	7.6%
M-ICU	4	5.1%
EMERGENCY EICU-1	3	3.8%
ORTHO-M	3	3.8%
SX-OT	3	3.8%
EMERGENCY-ICU-2	2	2.5%
EMERGENCY-OT	2	2.5%
HDHI	2	2.5%

ICCU-2	2	2.5%
LABOUR ROOM	2	2.5%
ONCO MED WARD	2	2.5%
PLASTIC SX - OT	2	2.5%
SURGERY ICU	2	2.5%
SX- ICU	2	2.5%
SURGERY -OT	1	1.3%
CCU	1	1.3%
EICU-2	1	1.3%
EMERGENCY-HDHI	1	1.3%
EMG ONCO	1	1.3%
GYNAE OT	1	1.3%
HDHI ICCU-3	1	1.3%
HDHI-ICCU-3	1	1.3%
ICCU-4	1	1.3%
NOOR	1	1.3%
NS-2	1	1.3%
NS-ICU	1	1.3%
NS-OT	1	1.3%
UROLOGY-RECOVERY	1	1.3%
Total	79	100.0%

Figure 6: %age of TRAEs reporting from different departments



Most Transfusion related events were recorded from

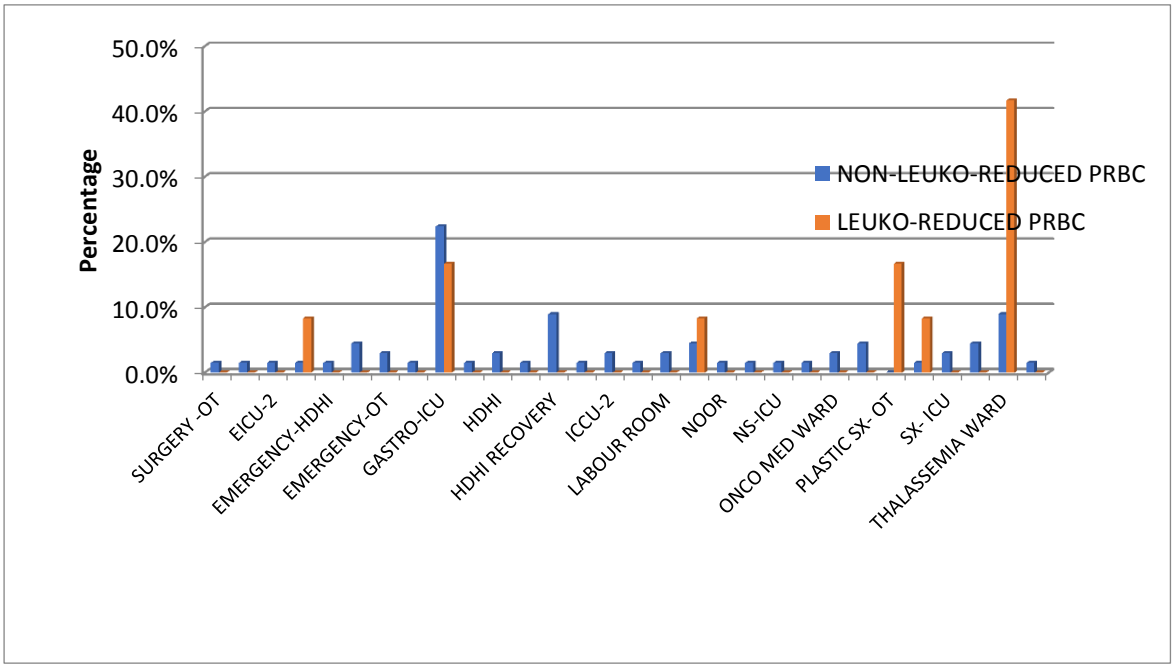
- **Gastro ICU** which is 21.5% (n=17),
- followed by **thalassemia** 13.9% (n=11),
- followed by **HDHI recovery** which is 7.6% (n=6),
- then **M-ICU** 5.1% (n=4).

Table 13: Number and %age of TRAEs reporting from different departments based on type of PRBCs unit transfused

		Non-leuko-reduced PRBCs		Leuko-reduced PRBCs		Total
		No. of cases	%age	No. of cases	%age	
PLACE OF TRANFUSION	GASTRO-ICU	15	22.4%	2	16.6%	17
	THALASSEMIA WARD	6	9.0 %	5	41.6%	11
	HDHI RECOVERY	6	9.0%	0	0.0%	6
	EMERGENCY-ICU 1	3	4.5%	0	0.0%	3
	M-ICU	3	4.5%	1	8.3%	4
	ORTHO-M	3	4.5%	0	0.0%	3
	SX-OT RECOVERY	3	4.5%	0	0.0%	3
	HDHI	2	3.0%	0	0.0%	2
	EMERGENCY-OT	2	3.0%	0	0.0%	2
	ICCU-2	2	3.0 %	0	0.0%	2
	LABOUR ROOM	2	3.0%	0	0.0%	2
	ONCO MED WARD	2	3.0%	0	0.0%	2
	SX-ICU	2	3.0%	0	0.0%	2
	HDHI-ICCU-3	2	3.0%	0	0.0%	2
	ICCU-4	1	1.5%	0	0.0%	1
	SURGERY-OT	1	1.5%	0	0.0%	1
	CCU	1	1.5%	0	0.0%	1
	EICU-2	1	1.5%	0	0.0%	1
	NS-2	1	1.5%	0	0.0%	1
	NS-ICU	1	1.5%	0	0.0%	1
	NS-OT	1	1.5%	0	0.0%	1

	UROLOGY-RECOVERY	1	1.5%	0	0.0%	1
	NOOR	1	1.5%	0	0.0%	1
	EMERGENCY-ICU-2	1	1.5%	1	8.3%	2
	EMG ONCO	1	1.5%	0	0.0%	1
	SURGERY ICU	1	1.5%	1	8.3%	2
	SURGERY- OT	1	1.5%	0	0.0%	1
	GYNAE OT	1	1.5%	0	0.0%	1
	PLASTIC SX-OT	0	0.0%	2	16.6%	2
Total		67	100.0%	12	100.0%	79

Figure 7: **%age of TRAEs reporting from different departments based on type of PRBCs unit transfused**



In case of non-leuko-reduced PRBCs, Most Transfusion related events were recorded from

- **Gastro ICU** which is 22.4% (n=15),
- followed by **thalassemia** 9% (n=6) and
- **HDHI recovery** which is 9% (n=6),

- then **M-ICU**,
- **Sx OT**,
- **Emergency ICU-1** which is 4.5% (n=3) each.

In case of Leuko-reduced PRBCs,

- Most Transfusion related events were recorded from **Thalassemia ward** which is 41.6% (n=5),
- followed by **Gastro ICU** and
- **Plastic Sx OT** 16.7% (n=2) each.

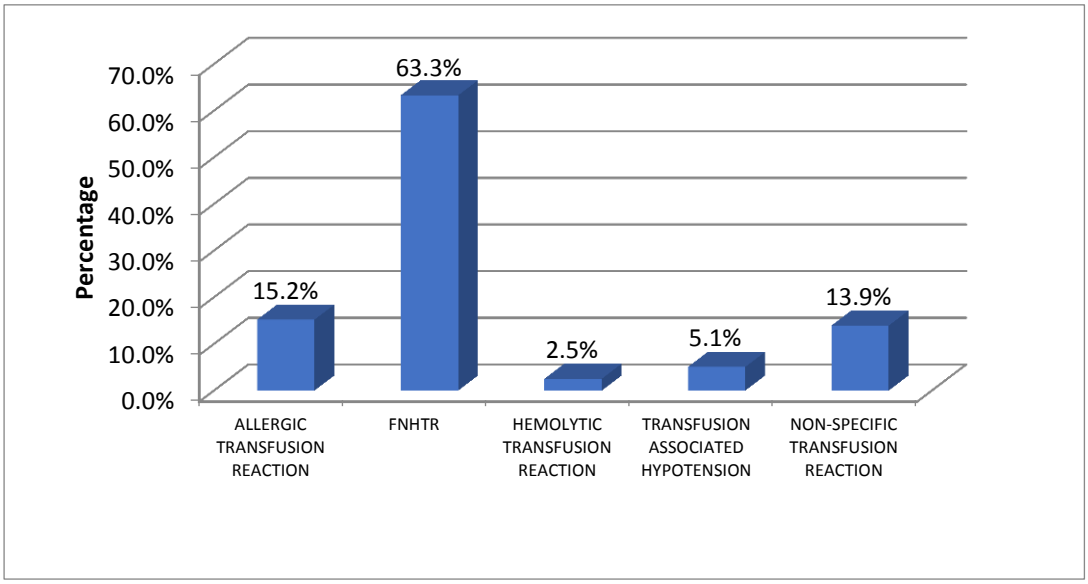
Chi-square value is 30.547

p-value is .387, which is insignificant.

Table 14: Number and %age of distribution of type of TRAE's among cases.

INTERPRETATION	No. of cases	Percentage
ALLERGIC TRANSFUSION REACTION	12	15.2%
FNHTR	50	63.3%
HEMOLYTIC TRANSFUSION REACTION	2	2.5%
TRANSFUSION ASSOCIATED HYPOTENSION	4	5.1%
NON-SPECIFIC TRANSFUSION REACTION	11	13.9%
Total	79	100.0%

Figure 8: % age of Type of transfusion Related adverse events among cases



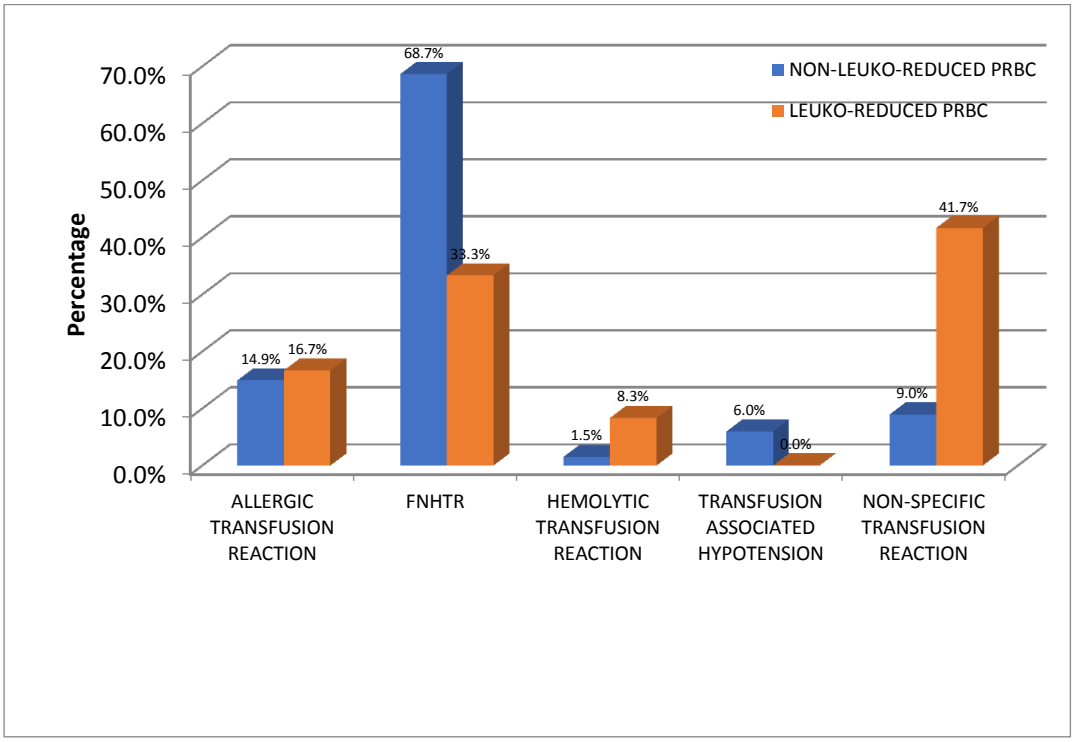
Out of 79 cases of transfusion related adverse events,

- 63.3% (n=50) were FNHTR.
- 15.2%(n=12) were Allergic transfusion reactions,
- 13.9%(n=11) were Non-specific transfusion reactions,
- 5.1% (n=4) were hypotensive transfusion reactions,
- 2.5% (n=2) were hemolytic transfusion reactions

Table 15: Number and %age Type of transfusion Related adverse events with respect to type of PRBCs unit transfused.

		TYPE OF UNIT				Total	chi-square value	p-value
		Non-leuko-reduced PRBCs		leuko-reduced PRBCs				
INTERPRETATION	ALLERGIC TRANSFUSION REACTION	10	14.9%	2	16.7%	12	12.445	0.014
	FNHTR	46	68.7%	4	33.3%	50		
	HEMOLYTIC TRANSFUSION REACTION	1	1.5%	1	8.3%	2		
	TRANSFUSION ASSOCIATED HYPOTENSION	4	6.0%	0	0.0%	4		
	NON-SPECIFIC TRANSFUSION REACTION	6	9.0%	5	41.7%	11		
Total		67	100.0%	12	100.0%	79		

Figure 9: %age Type of transfusion Related adverse events with respect to type of PRBCs unit transfused



Out of 79 cases of transfusion related adverse events,
67 reactions were due to non-leuko-reduced PRBCs.

- 68.7% (n=46) were FNHTR.
- 14.9%(n=10) were Allergic transfusion reactions,
- 9%(n=6) were Non-specific transfusion reactions,
- 6% (n=4) were transfusion associated Hypotension.
- 1% (n=1) were hemolytic transfusion reactions.

Out of 79 cases of transfusion related adverse events,
12 reactions were due to leuko-reduced PRBCs

- 3.3% (n=4) were FNHTR.
- 16.7%(n=2) were Allergic transfusion reactions,
- 41.7%(n=5) were Non-specific transfusion reactions,
- 8.3% (n=1) were hemolytic transfusion reactions.

Chi-square root is 12.445
p-value is **0.014**, which is **significant.**

Transfusion history

Table 16: Number and %age of Transfusion history among cases.

TRANSFUSION HISTORY	No. of cases	Percentage
NEGATIVE	29	36.7%
POSITIVE	50	63.3%
Total	79	100.0%

In 63.3% cases there was history of previous transfusion while in remaining 36.7% there was no history of previous transfusion present.

Figure 10: %age of Transfusion history among cases.

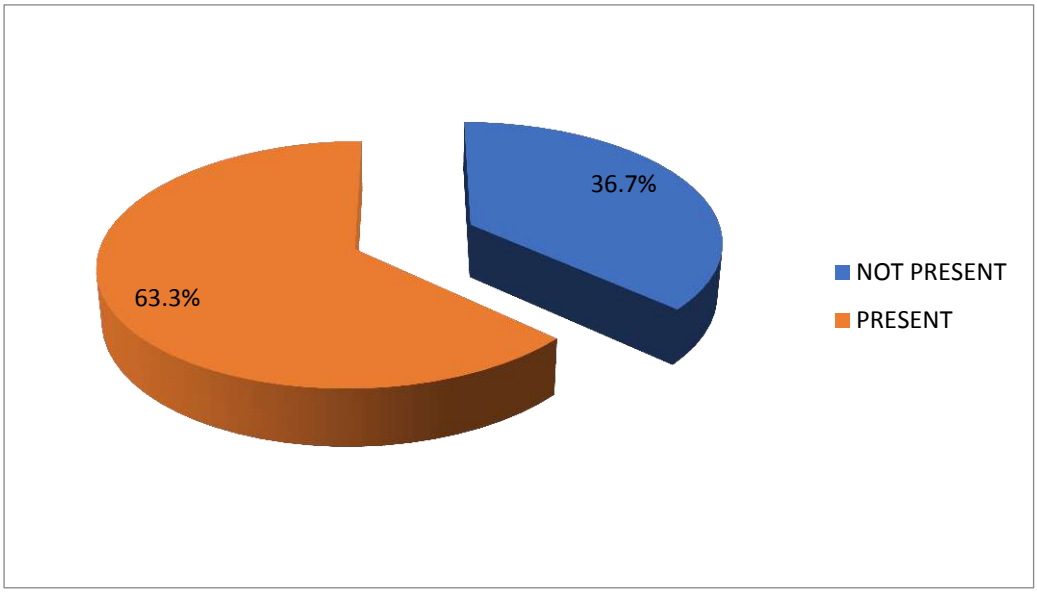
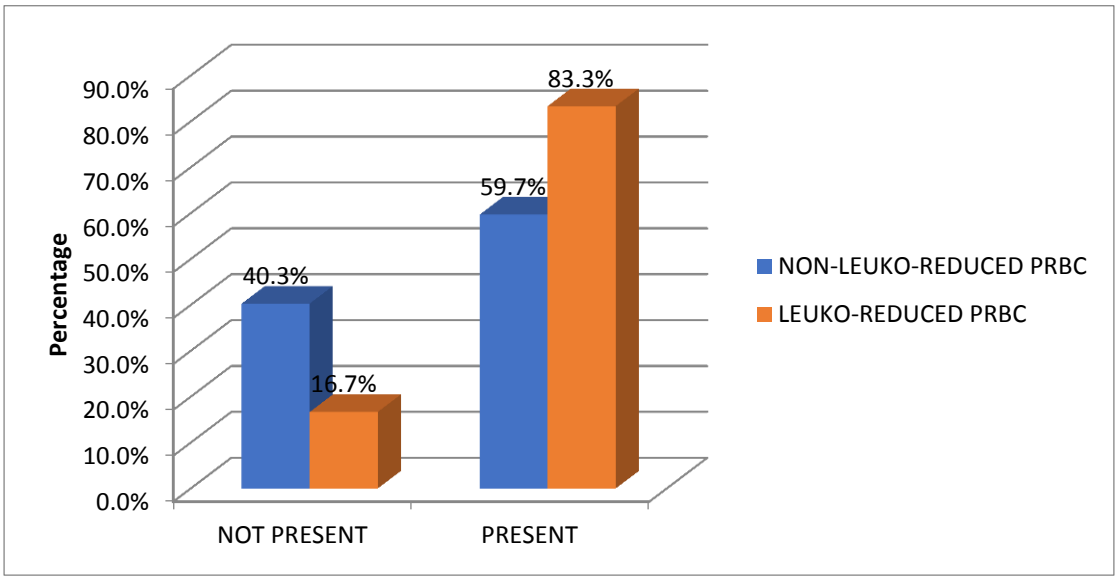


Table 17: Effect of transfusion history on number and %age of cases among different type of PRBCs unit.

	TYPE OF UNIT	Non-leuko- reduced PRBCs		leuko- reduced PRBCs		Total	chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
TRANSFUSION HISTORY	N	27	40.3%	2	16.7%	29	2.446	0.118
	P	40	59.7%	10	83.3%	50		
Total		67	100.0%	12	100.0%	79		

Figure 11: Effect of transfusion history on %age of cases among different type of PRBCs unit.



In case of non-leuko-reduced PRBCs,

- in 59.7%(n=40) case there was history of transfusion present,
- while in 40.3% (n=27) there was no transfusion.

While in case of Leuko-reduced PRBCs

- in 83.3% (n=10) cases there was transfusion present,
- while in 16.7% (n=2) there was no transfusion.

Chi-square value is 2.446.

p-value is 0.118, which is insignificant.

Any clerical Error

Table 18: Number and %age of clerical error among cases.

ANY CLERICAL ERROR	No. of cases	Percentage
NOT PRESENT	77	97.5%
PRESENT	2	2.5%
Total	79	100.0%

- In 97.5% (n=77) cases there was no clerical error present.
- while in 2.5% (n=2) cases there was transfusion of incompatible blood units.

Figure 12: **%age of clerical error among cases.**

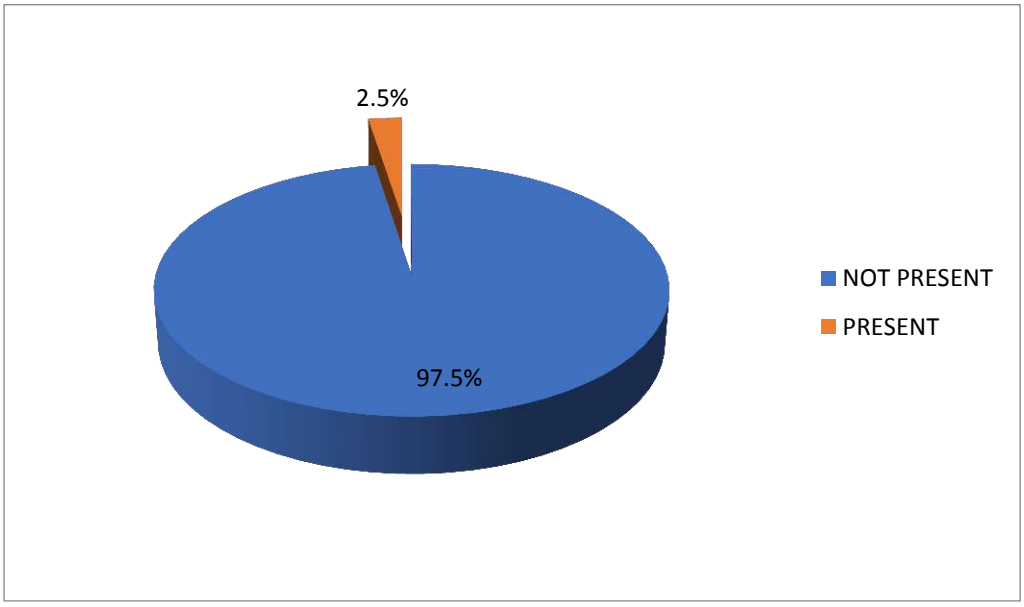
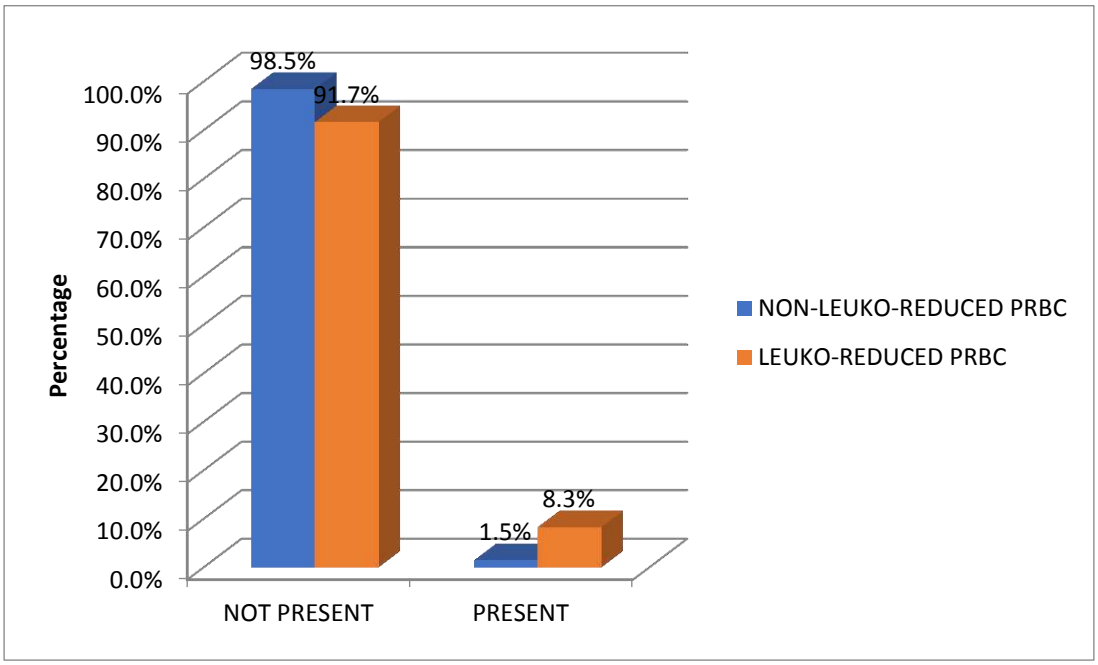


Table 19: **Number and %age of distribution of clerical error causing TRAEs among different type of PRBCs unit transfused**.

	TYPE OF UNIT	NON-LEUKO-REDUCED PRBCs		LEUKO- REDUCED PRBCs		Total	chi-square value	p-value
		No. of cases	%age	No. of cases	%age			
ANY CLERICAL ERROR	NOT PRESENT	66	98.5%	11	91.7%	77	1.93	0.165
	PRESENT	1	1.5%	1	8.3%	2		
Total		67	100.0%	12	100.0%	79		

Figure 13: %age of distribution of clerical error causing TRAEs among different type of PRBCs unit transfused



In pre-transfusion sample,

in non-leuko-reduced PRBCs,

- 98.5% (n=66) cases were compatible,
- 1.5%(n=1) cases were incompatible**.**

In leuko-reduced PRBCs,

- 91.7% (n=11) cases were compatible,
- 8.3%(n=1) cases were incompatible.

Chi square root is 1.930.

p-value is 0.282, which is insignificant.

DISCUSSION

The present study was done to find out the comparison of transfusion related adverse events between leuko-reduced PRBCs and Non-leuko-reduced PRBCs in blood transfusion recipients during the period of April 2021- March 2022.

During the study period, 23842, Packed red blood cells were transfused; Out of which, Packed Red blood cells were 14383 and Leuko-reduced packed red blood cells were 9459. 0.3% transfusion related adverse events were observed.

Table 20: **Following are some similar studies with %age of Transfusion related adverse events with respect to present study:**

Author	Transfusion related adverse events %age
Shanthala Devi [19]	0.26
King et al [25]	0.40
Yazer et al [26]	0.25
Khalid et al [48]	0.082
Present study	0.3

Among these 0.3% cases of transfusion related adverse events were reported. Out of which, 0.5% were from non-leuko-reduced PRBCs while 0.1% were from leuko-reduced PRBCs. In a similar study, 37,232 RBC units issued during study period of 2 years, out of which 23083 were non-leuko-reduced packed RBC's while 14149 were leuko-reduced PRBC's.

0.38% transfusion related adverse events occurs, out of which 0.5% reactions were from non-leuko-reduced PRBC's while 0.1% were from leuko-reduced PRBCs.[27]

Table 21: Comparison of % of TRAE's in non -leuko-reduced and leuko-reduced PRBCs of various studies with present study

Author	% of TRAEs in non-leuko-reduced PRBCs	% of TRAE's in leuko-reduced PRBCs
Rajesh et al [27]	0.5	0.1
Dutt, N et al [49]	4.1	0.8
Pahuja S,et al [50]	0.08	0.03
King et al[25]	0.37	0.19
Yazer et al [26]	0.33	0.19
Present study	0.5	0.1

AGE DISTRIBUTION:

In present study,

- There were 15.2% cases from age group less than 20 years of age.
- 17.7% cases in 21-40 years age group.
- 38% cases in 41-60 age group and
- 29.1% cases in more than 60 years age group.

Most adverse events were from age group 41-60 years of age and >60 years age respectively. Most common cause for adverse events in this age group mainly is presence of Multiple Co-morbidities.

In a similar study by Oakley et al, out of 133,671 transfusions.

- <21 year of age, incidence is 6.2 per 1000 transfusions.
- >21 year of age, incidence is 2.4 per 1000 transfusions.[51]

Table 22: Comparison of TRAEs in different age-groups of similar study with present study.

Author	<20 years age group %	>20 years age group %
Oatkley et al [51]	0.62	0.24
Present study	0.05	0.28

GENDER DISTRIBUTION:

Out of 79 cases, 41.8% were females and 58.2% were males. Most cases were from male population. Similar results observed in studies done by Kumar et al[23] and Bhattacharya et al[22] that show a high incidence of transfusion related adverse events in males, 54.3% and 65.8%, respectively.

Table 23: Comparison of Gender distribution of TRAE's of various studies with present study.

Author	%age of Females	%age of Males	%age of transgender
Kumar et al [23]	45.7	54.3	0
Bhattacharya et al[22]	34.2	65.7	0
Vaithy K. et al [52]	38	61	1
Alsughayir, A et al [53]	53.79	46.21	0
Present study	41.8	58.2	0

BLOOD GROUPING DISTRIBUTION OF PATIENTS:

In our study, out of total transfusion related adverse events:

- 17.7% belongs to group A+,
- 13.9% belongs to AB+,
- 43.0% belongs to B+ group,
- 18.9% belongs to O+ group.
- 2.5% are B- group.
- while 3.7% belongs to O- group.

Most cases were from B+ Blood group, as maximum population in North India belongs to Blood group B+, According to Mangwana, et al [54] So maximum number of transfusions were of blood group B. Hence, the maximum transfusion related adverse events.

Table 24: Comparison of Blood group distribution among TRAE's of similar study with present study.

Author	A%age	B+%age	AB+%age	O+%age	A-%age	B-%age	AB-%age	O-%age
Vaithy K. et al [52]	18.5	26.5	34	21	0	0	0	0
Present study	17.7	43	13.9	18.9	0	2.5	0	3.7

Relative frequency of department reporting Acute transfusion Adverse Events:

Most Transfusion related events were recorded from

- Gastro ICU which is 21.5%
- followed by thalassemia 13.9%
- followed by 10.1% in SX and emergency.
- followed by HDHI recovery which is 7.6%
- then M-ICU 5.1%
- Maximum reactions were from Gastro ICU, because in this study maximum transfusions were from Gastro ICU. Most transfusions from our department to Gastro ICU were to patients with increased risk of bleedings. Most patients were diagnosed with chronic liver disease and cirrhosis leading to coagulation disorders due to decrease clotting factors, vitamin K deficiency, esophageal varies. Another major cause was Upper GI Bleed due to Peptic ulcers. Some patients were diagnosed with Inflammatory bowel disease.

Table 25: Comparison of TRAE's among different departments of a similar study with present study.

author	Obs/gynae	surgery	medicine	gastro	thalasemia	HDHI	EMERGENCY
Vaithy K. et al [52]	1.3%	1.9%	0	ND	ND	ND	ND
Present study	3.7%	10.1%	5.1%	21.5%	13.9%	7.6%	10.1%

TRANSFUSION HISTORY

In 63.3% cases there was history of previous transfusion.

Table 26: Presence of Transfusion History in TRAE's among various studies

AUTHOR	% age of transfusion History present
Bhattacharya et al [22]	52.38
Present study	63.3

FNHTR:

We found a significant difference in the incidence of FNHTRs, that is, 0.5% versus 0.1% in non-leuko-reduced PRBC's and leuko-reduced PRBCs respectively.

Several recent clinical trials have confirmed that pre-storage leuko-reduction is effective in reducing the rate of FNHTRs to approximately 50% with residual rates well below 1%. [21,24,25]

Fever was the most common clinical symptom followed by chills and rigors. In some cases tachycardia was also observed.

Granulocyte, platelet, and human leucocyte antigen (HLA)-specific antibodies have all been linked to the pathophysiology of FNHTRs. Interleukin 1 is one of the cytokines that might result in fever when the recipient's antibodies react with transfused antigens.[31]

Table 27: Comparison of FNHTR in non- leuko-reduced VS leuko-reduced PRBCs in various studies.

Author	Non-leuko-reduced PRBCs %	Leuko-reduced PRBCs %
Bhattacharya et al [22]	0.33	0.19
Kumar et al [23]	0.34	0.18
Shantala Devi and Gaikhonlungpou[19]	0.58	0.23
King et al[25]	0.37	0.19
Serinolli et al [55]	3.6	1
Khoyumthem P et al [56]	42	0
Ulhman et al [42]	0.12	0.08
Present study	0.3	0.04

Serinolli et al. [55] reported a prospective trial in which the rate of FNHTRs to non-leuko-reduced RBCs was 3.6% significantly higher than the rate of FNHTR's to leuko-reduced RBCs which was 1.0%.

ALLERGIC REACTION:

Incidence of allergic reactions was found to be the second highest, constituting 15.2% in the present study. This study correlate well with the study by Khalid et al [48], Bhattacharya et al [22], which also showed the second highest prevalence of allergic reactions in their studies.

There is a significant difference in the incidence of allergic reaction, that is, 12.6% versus 2.5% in non-leuko-reduced PRBC's and leuko-reduced PRBCs.

Most common symptoms were rashes, itching and urticaria respond to antihistamine therapy.

Table 28: Comparison of Allergic Reactions in non- leuko-reduced VS leuko-reduced PRBCs in various studies.

Author	%age of Non-leuko-reduced PRBCs	%age of Leuko-reduced PRBCs
Pahuja S,et al[50]	0.103	0.031
Rahim R et al[57]	25	0
Alsughayir, A et al[53]	14.3	0
Khoyumthem P et al [56]	0.59	0
Bhattacharya et al [22]	0.87	0
Ulhman et al[42]	0.04	0.06
Present study	12.6	2.5

HEMOLYTIC TRANSFUSION REACTION:

In this study, we did encounter ABO mismatched transfusion which was due to clerical error at bed-side of patient as two patients were of similar name but of different MRD number and different blood groups. Patient develop abdominal pain and the transfusion was immediately stopped. Appropriate measures were taken and the patient did not suffer from any serious consequences.

So, risk factors associated with acute ABO incompatible hemolytic reactions were mainly technical or clerical errors. Clerical errors include misidentification of the patient or the recipient**.**

Second hemolytic transfusion related adverse events was due to mismatched-phenotype transfusion of Kell antigen in patient with Kell antibody.

Table 29: Comparison of Hemolytic Transfusion Reactions in non-leuko-reduced VS leuko-reduced PRBCs in various studies.

Author	Non -leuko-reduced prbcs %age	Leuko-reduced prbcs %age
Khoyumthem P et al [56]	0.04	0
Pahuja S, et al [50]	1.7	0
Bhattacharya et al[22]	0.21	0
Present study	1.3	1.3

TRANSFUSION ASSOCIATED HYPOTENSION:

- Hypotension was encountered in 5.1% cases.
- All cases were due to non-leuko-reduced PRBCs.

All TAH were seen with non-leuko-reduced PRBCs. PRBCs and the patients were already on treatment either with ACE inhibitors or on dialysis.

Table 30: Comparison of Transfusion associated hypotension in non- leuko-reduced VS leuko-reduced PRBCs in various studies.

Author	Non-leuko-reduced PRBCs %age	Leuko-reduced PRBCs % age
Alsughayir, A et al[53]	0.75	0
Vaithy K. et al[52]	7.14	0
Present study	5.1	0

NON-SPECIFIC TRANSFUSION REACTIONS:

Those reactions which can't be categorized into definitive category have been placed in non-specific Transfusion reactions Category. Symptoms mainly contain Nausea, Vomiting, tachy-apnoea, Bronchospasm.

Table 31: **Comparison of Non-Specific Transfusion Reaction in non- leuko-reduced VS leuko-reduced PRBCs in various studies.**

Author	Non-leuko-reduced PRBC %age	Leuko-reduced PRBC
Alsughayir, A et al[53]	0.75	0
Khoyumthem P et al [56]	0.04	0
Ulhman et al[42]	0.022	0.012
Kumar R et al[58]	0.10	0
Present study	7.5	6.3

Hemovigilance is currently regarded as a quality indicator and is used as a crucial part of quality control in transfusion medicine worldwide.[47,49] Data on hemovigilance are useful for developing new strategies to enhance blood safety and modify existing ones to reduce transfusion-related adverse events. The incidence of the most critical occurrences has increased since India's hemovigilance Programme was put into place, although the mortality directly associated with transfusions has dropped.

SUMMARY AND CONCLUSION

SUMMARY

- Our study was aimed to evaluate the Transfusion related adverse events due to PRBCs, both leuko-reduced PRBCs and non-leuko-reduced.
- During the study period, **23842** units of total packed red cells units were transfused to patients PRBCs. Packed red blood cells-**14383** Leuko-reduced packed red blood cells- **9459**.
- **79** patients had transfusion related adverse events during or after transfusion within 24 hours.
- Out of 79 transfusion related adverse events, 67 were due to non-leuko-reduced PRBCs and 12 Leuko-reduced PRBCs.
- Among the 79 TRAEs, 50 patients (63.3%) were present with H/o previous sensitization.
- The incidence of FNHTR was maximum observed in 50 (63.3%) patients, followed by Allergic Transfusion Reaction in 12(15.2%) patients, followed by Non-specific transfusions reactions in 11 (13.9%), followed by 5.1% (n=4) cases of transfusion associated hypotension. Followed by 2.5% (n=2) hemolytic transfusion reactions. All patients were managed successfully and no casualty due to transfusion related adverse events was reported.
- Maximum cases of ATRs were from Gastro ICU 17 (21.5%) Transfusion related adverse events.
- Most transfusion related adverse events were from age group 40-60 years of age f/b >60 years of age.
- Of the 79 patients who had TRAEs, 46 (58.2%) were males and 33 (41.8%) were females.
- In our study, cases from non-leuko-reduced PRBCs were 67. Most common were FNHTR 68.7% (n=46), F/b Allergic transfusion reactions which were 14.9%(n=10), then 9% (n=6) were non-specific transfusion reaction, followed by 6% (n=4) transfusion associated hypotension, then 1% (n=1) were hemolytic transfusion reactions.

- In our study, cases from leuko-reduced PRBCs were 12. Most common were non-specific transfusion reaction i.e 41.7% (n=5), f/b 33.3% (n=4) FNHTR f/b 16.7% (n=2) Allergic transfusion reactions, then 8.3% (n=1) were hemolytic transfusion reactions.
- There was clerical error present while in 2.5% (n=2) cases due to transfusion of incompatible blood units

CONCLUSION:

Our investigation showed that the rate of TRAEs to PRBCs units significantly decreased after pre-storage leuko-reducing inline filters were installed, especially FNTHRs. Although residual FNHTRs are caused by the buildup of cytokines and chemokines during cellular blood product storage. So, this is one of the many factors promoting the usage of pre-storage leuko-reduced PRBCs. Patients who get many transfusions, particularly those with thalassemia major and oncology patients who require transfusions on a constant basis, can benefit most from such leuko-reduced RBCs**.**

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S. No.	PATIENT NAME	AGE	AGE GROUP	SEX	MRD NUMBER	PLACE OF TRANFUSION	TYPE OF UNIT	UNIT NUMBER	DT OF UNIT COLLECTION	EXPIRY DT	DT AND TIME OF SUPPLY	DT AND TIME OF TRANSFUSION	TIME OF RECEIVING OF REACTION BAG WITH SAMPLE	ANY CLERICAL ERROR	TRANSFUSION HISTORY	DIAGNOSIS
1	R	29	2	M	1024081	GASTRO-ICU	D	63251	24-02-2021	06-04-2021	05-03-2021 ; 12:15PM	05-03-2021; 12:30PM	05-03-2021 ; 9:00PM	P	P	ACUTE PANCREATITIS
2	MS	67	4	M	1042334	M-ICU	D	63523	01-03-2021	11-04-2021	08-03-2021 ; 5:00 AM	08-03-2021 ; 5: 30 AM	08-03-2021 ; 6: 00 AM	N	N	LOWER GI BLEED
3	PK	30	2	F	739077	SX- OT	D	64285	11-03-2021	21-04-2021	18-03-2021 ; 12:00 PM	18-03-2021 ; 12:20 PM	18-03-2021 ; 12:40 PM	N	P	CYST IN THIGH
4	RS	67	4	M	1052295	HDHI RECOVERY	D	64747	19-03-2021	29-04-2021	21-03-2021 ; 3:40PM	21-03-2021 ; 4:00 PM	21-03-2021 ; 6:30 PM	N	P	HTN , CAD , POST CABG , TVD
5	T	3	1	F	582615	THALASSEMIA WARD	D	64845	20-03-2021	30-04-2021	22-03-2021 ; 12:30PM	22-03-2021 1:00PM	22-03-2021 3:30PM	N	P	THALASSAEMIA MAJOR
6	AB	48	3	F	1021979	LABOUR ROOM	D	65066	23-03-2021	03- 05-2021	26-03-2021 ;1:48PM	26-03-2021 ; 2:45PM	26-03-2021 ; 5:30PM	N	P	HYSTERTECTEMY
7	HK	48	3	F	1026695	ONCO MED WARD	D	65026	22-02-2021	02-05-2021	01-04-2021 ; 9:00PM	01-04-2021 ; 9:30PM	02-04-2021; 12:30AM	N	P	MYELODYSPLASTIC SYNDROME
8	PK	48	3	F	329307	GYNAE OT	D	65717	02-04-2021	12-05-2021	07-04-2021; 5:50AM	07-04-2021; 6:15AM	07-04-2021; 9:00AM	N	N	FIBROID UTERUS
9	VL	15	1	F	1078031	GASTRO-ICU	D	65897	06-04-2021	16-05-2021	10-04-2021; 12:24PM	10-04-2021; 12:35PM	10-04-2021; 6:00 PM	N	N	IBD
10	SS	45	3	M	1007163	GASTRO-ICU	D	65900	07-04-2021	17-05-2021	12-04-2021; 5:40PM	12-04-2021; 6:00PM	12-04-2021; 9:15PM	N	N	CLD , HCV
11	DR	67	4	M	1074586	ORTHO-M	D	65133	24-03-2021	04-05-2021	12-04-2021; 2:00PM	12-04-2021 ; 3:30PM	12-04-2021 ; 6:00PM	N	P	FLAP COVER SURGERY
12	PM	45	3	F	1059416	GASTRO-ICU	D	66120	11-04-2021	21-05-2021	13-04-2021; 4:20PM	13-04-2021; 4:40PM	13-04-2021; 5:30PM	N	N	PAIN ABDOMEN
13	YK	27	2	M	112909	THALASSEMIA WARD	D	66678	14-04-2021	29-05-2021	21-04-2021;12:40PM	21-04-2021 ;1:30PM	21-04-2021 ;4:30 PM	N	P	THALASSEMIA MAJOR
14	K	6	1	M	28076	THALASSEMIA WARD	D	66631	18-04-2021	30-05-2021	24-04-2021 ; 12:30PM	24-04-2021 ; 1:30PM	24-04-2021 ; 5:00PM	N	P	THALASSEMIA MAJOR
15	MD	51	3	F	1093630	EMG ONCO	D	66351	14-04-2021	24-05-2021	26-04-2021; 9:30PM	26-04-2021; 11:00PM	27-04-2021; 2:00AM	N	P	AFI
16	SS	41	3	M	904278	GASTRO-ICU	D	66545	16-04-2021	26-05-2021	03-05-2021 ;7:00PM	03-05-2021 ;7:30PM	04-05-2021 ;12:00AM	N	P	LIVER CIRRHOSIS AND PHTN
17	S	6	1	M	112409	THALASSEMIA WARD	I	67315	04-05-2021	08-06-2021	08-05-2021 ; 1:30PM	08-05-2021 ; 2:00PM	08-05-2021; 3:00PM	N	P	THALASSAEMIA MAJOR
18	RS	12	1	M	36957	THALASSEMIA WARD	D	67363	05-05-2021	09-06-2021	08-05-2021 ; 1:00PM	08-05-2021 ; 1:30PM	08-05-2021 ; 5:00PM	N	P	THALASSAEMIA MAJOR
19	BS	36	2	M	1056553	GASTRO-ICU	D	66840	23-04-2021	03-06-2021	16-05-2021;1:40PM	16-05-2021 ;4:30PM	16-05-2021;8:00PM	N	P	ACUTE PANCREATITIS
20	BS	36	2	M	1056553	GASTRO-ICU	I	67090	30-04-2021	10-06-2021	18-05-2021 ; 6:00PM	18-05-2021 ;8:00PM	18-05-2021 ; 8:30PM	N	P	ACUTE PANCREATITIS
21	ST	24	2	M	20793	THALASSEMIA WARD	I	67999	21-05-2021	02-07-2021	25-05-2021;3:30PM	25-05-2021; 3:45PM	25-05-2021 ; 6:30PM	N	P	THALASSEMIA MAJOR
22	DV	7	1	M	106358	THALASSEMIA WARD	I	68252	25-05-2021	05-07-2021	27-05-2021 ;11:55AM	27-05-2021 ; 12:30PM	27-05-2021 ; 3:30PM	N	P	THALASSEMIA MAJOR
23	AA	13	1	M	22698	THALASSEMIA WARD	I	68556	30-05-2021	10-07-2021	01-06-2021; 3:30PM	01-06-2021; 3:40PM	01-06-2021 ; 6:00PM	N	P	THALASSEMIA MAJOR
24	HK	74	4	F	65029	ICCU-4	D	68610	30-05-2021	10-07-2021	02-06-2021; 4:45PM	02-06-2021; 5:10PM	02-06-2021 ; 8:00PM	N	N	CKD,CLD,HTN,DM2,AFI,UTI
25	S	50	3	F	1113465	GASTRO-ICU	D	68840	30-05-2021	10-07-2021	05-06-2021;10:50AM	05-06-2021 ; 11:00AM	05-06-2021 ;2:30PM	N	P	SX OF BOWEL OBSTRUCTION
26	RA	70	4	M	26983	NOOR	D	68537	29-05-2021	09-07-2021	06-06-2021 ; 12:31PM	06-06-2021 ;1:30PM	06-06-2021 ; 2:00PM	N	P	SX FEMUR FRACTURE
27	R	59	3	M	173041	EMERGENCY-ICU 1	D	69203	09-06-2021	19-07-2021	13-06-2021; 4:50PM	13-06-2021; 5:50PM	13-06-2021; 9:00PM	N	P	SEPTIC SHOCK ,UTI
28	SK	43	3	F	1121867	EMERGENCY - ICU-2	D	69433	11-06-2021	21-07-2021	14-06-2021; 8:00PM	14-06-2021; 11:00PM	14-06-2021 ; 12:30PM	N	N	IBD WITH ANEMIA
29	IS	45	3	M	1123962	HDHI RECOVERY	D	70057	18-06-2021	28-07-2021	20-06-2021; 4:35PM	20-06-2021; 4:50PM	20-06-2021 ; 9:30PM	N	P	SEVERE ANEMIA
30	KS	59	3	M	1124639	UROLOGY-RECOVERY	D	69978	17-06-2021	27-07-2021	21-06-2021 ; 11:00AM	21-06-2021 ;11:15AM	21-06-2021; 2:15PM	N	P	CA BLADDER , ANEMIA
31	J	35	2	M	1127149	HDHI RECOVERY	D	69569	17-06-2021	23-07-2021	26-06-2021; 11:15AM	26-06-2021; 12:30PM	26-06-2021; 5:30PM	N	P	CONSTRICTIVE PERICARDITIS
32	HS	18	1	M	119170	THALASSEMIA WARD	D	70572	27-06-2021	07-08-2021	29-06-2021 ; 11:00AM	29-06-2021 ; 11:30AM	29-06-2021 ; 03:30AM	N	P	THALASSEMIA MAJOR
33	KB	63	4	F	1111132	M-ICU	I	70470	25-06-2021	05-08-2021	27-06-2021 ; 4:00PM	27-06-2021 ;4:30PM	27-06-2021 ;6:35PM	N	N	CLD
34	RS	72	4	M	711183	CCU	D	70530	26-06-2021	06-08-2021	01-07-2021 ; 1:26PM	01-07-2021 ; 2:10PM	01-07-2021 ; 4:10PM	N	N	DM2 , HTN ,TVD
35	TD	45	3	F	1126238	GASTRO-ICU	D	69097	07-06-2021	17-07-2021	02-07-2021 ;3:00PM	02-07-2021 ;4:30PM	02-07-2021 :9:45PM	N	P	AKI
36	AJ	47	3	F	1128392	SURGERY ICU	I	70894	02-07-2021	12-08-2021	04-07-2021 ; 1:05PM	04-07-2021 ; 1:45PM	04-07-2021 ; 5:45PM	N	N	POST-OP
37	SK	47	3	F	1133270	SURGERY -OT	D	71843	18-07-2021	28-08-2021	20-07-2021 ; 2:50PM	20-07-2021 ;4 :00PM	20-07-2021; 9:00PM	N	P	WOUND DEBRIDEMENT
38	JS	62	4	M	1137982	SURGERY ICU	D	71789	18-07-2021	28-08-2021	22-07-2021 ;11:05AM	22-07-2021 ;1:00PM	22-07-2021 ; 2:45PM	N	P	POST-OPERATIVE
39	RK	55	3	M	171901	GASTRO-ICU	D	72137	24-07-2021	04-09-2021	28-07-2021 ; 10:40PM	28-07-2021 ;11:15PM	29-07-2021 ;3:00AM	N	N	CLD
40	SS	62	4	M	1442015	GASTRO-ICU	D	71734	18-07-2021	28-08-2021	31-07-2021 ; 3:00PM	31-07-2021 ; 3:30PM	31-07-2021 ; 6:00PM	N	N	ALD
41	MK	62	4	F	1143878	HDHI RECOVERY	D	72453	27-07-2021	07-09-2021	02-08-2021 ;11:15AM	02-08-2021 ;11:30AM	02-08-2021 ;12:45PM	N	P	AKI , HTN , DM-2
42	SS	62	4	M	144215	GASTRO-ICU	D	72835	02-08-2021	12-09-2021	04-08-2021 ;9:30AM	04-08-2021 ;11:30AM	04-08-2021 ;3:30PM	N	P	CIRRHOSIS
43	PR	42	3	F	1163780	M-ICU	D	74755	28-08-2021	09-10-2021	01-09-2021 ; 5:35PM	01-09-2021 ; 6:35PM	01-09-2021 ; 9:35PM	N	P	AFI WITH TCP
44	BS	45	3	M	1166941	SX- ICU	D	75043	02-09-2021	12-10-2021	07-09-2021 ; 4:20PM	07-09-2021 ; 4:45PM	07-09-2021 ; 7:30PM	N	P	AMPUTATION
45	M	18	1	M	1166864	SX- ICU	D	75687	11-09-2021	21-10-2021	14-09-2021 ; 6:45 PM	14-09-2021 ; 7:00PM	15-09-2021 ;3:00AM	N	P	PERITONEAL LEAKAGE
46	SD	36	2	F	1184070	NS-ICU	D	77073	02-10-2021	12-11-2021	04-10-2021 ; 10:25PM	04-10-2021 ; 11:25PM	05-10-2021 ; 02:00AM	N	N	SDH
47	SD	45	3	F	105447	M-ICU	D	77059	02-10-2021	12-11-2021	05-10-2021 ; 01:00AM	05-10-2021 ; 02:00AM	05-10-2021 ; 06:00AM	N	N	MYASTHENIA GREVIS
48	MK	66	4	F	61207	GASTRO-ICU	D	77799	10-10-2021	20-11-2021	16-10-2021 ; 12:30PM	16-10-2021 ; 1 ;00PM	16-10-2021 ; 1:30PM	N	P	CIRRHOSIS
49	SS	50	3	F	1192601	HDHI RECOVERY	D	78170	16-10-2021	26-11-2021	23-10-2021 ; 12:00PM	23-10-2021; 12:30PM	23-10-2021; 6:30PM	N	N	MI
50	HK	75	4	F	408245	HDHI-ICCU-3	D	78961	27-07-2021	07-12-2021	29-10-2021 ; 6:50PM	29-10-2021 ; 7:10PM	29-10-2021 ; 11:30PM	N	N	MI
51	HS	62	4	M	1206753	EMERGENCY-HDHI	D	79987	12-11-2021	21-12-2021	14-11-2021 ; 1:35PM	14-11-2021 ; 2:30PM	14-11-2021 ; 6:15 PM	N	N	MI
52	SG	55	3	M	126168	GASTRO-ICU	D	80058	13-11-2021	23-12-2021	15-11-2021 ; 11:20PM	15-11-2021 ; 11:50PM	16-11-2021 ; 12:50 AM	N	N	CIRRHOSIS ,DM2 , ACLF
53	SK	79	4	F	1210867	EMERGENCY-ICU 1	D	80717	22-11-2021	01-01-2022	24-11-2021 ; 12 :00 PM	24-11-2021 ; 1:00PM	24-11-2021 ; 5:00 PM	N	P	MR, PLEURAL EFFUSION, CKD
54	KK	38	2	M	1214944	EMERGENCY - ICU-2	I	80507	20-11-2021	10-01-2022	27-11-2021 ; 7:45PM	27-11-2021 ; 8:30PM	27-11-2021 ; 10:45 PM	N	P	DM2 , AFI , TCP , ANAEMIA
55	BK	62	4	F	1202097	NS-2	D	81066	26-11-2021	06-01-2022	27-11-2021 ; 11:45PM	27-11-2021 ; 1155PM	28-11-2021 ;5:00 AM	N	N	VENTRICULAR HAEMMORHAGE

S. No.	SIGNS / SYMPTOMS	APP VOLUME IN BAG	VISUAL ASSESSMENT OF BAG AND TUBE	PRE-TRANSFUSION HAEMOLYSIS	PRE-TRANSFUSION ICTERUS	POST-TRANSFUSION HAEMOLYSIS	POST-TRANSFUSION ICTERUS	PRE-TRANSFUSION CELL GROUPING	PRE- TRANSFUSION SERUM GROUPING	PRE-TRANSFUSION ABO GROUPING
1	PAIN ABDOMEN	150	WNL	N	P	P	P	B	B	B
2	SHIVERING, TACHYCARDIA	100	WNL	N	N	N	N	B	B	B
3	HYPOTENSION	250	WNL	N	N	N	N	A	A	A
4	CHILLS	110	WNL	N	N	N	N	B	B	B
5	RASHES , ICHING	50	WNL	N	N	N	N	B	B	B
6	TACHYCARDIA , SHIVERING	100	WNL	N	N	N	N	B	B	B
7	FEVER WITH CHILLS AND SHIVERING	120	WNL	N	N	N	N	A	A	A
8	NAUSEA , VOMITING , SHIVERING	120	WNL	N	N	N	N	B	B	B
9	CHILLS, SHIVERING	100	WNL	N	N	N	N	A	A	A
10	FEVER WITH CHILLS AND SHIVERING	20	WNL	N	N	N	N	O	O	O
11	FEVER WITH CHILLS, SHIVERING	90	WNL	N	N	N	N	A	A	A
12	SHIVERING	290	WNL	N	N	N	N	O	O	O
13	SHIVERING	150	WNL	N	N	N	N	O	O	O
14	RASHES , ICHING	40	WNL	N	N	N	N	B	B	B
15	SHIVERING , HYPOTHERMIA	200	WNL	N	N	N	N	B	B	B
16	SHIVERING	150	WNL	N	N	N	N	O	O	O
17	SHIVERING	10	WNL	N	N	N	N	O	O	O
18	FEVER	20	WNL	N	N	N	N	B	B	B
19	FEVER WITH SHIVERING ,TACHYCARDIA	180	WNL	N	N	N	N	AB	AB	AB
20	RASHES , SHIVERING	250	WNL	N	N	N	N	AB	AB	AB
21	APAIN ABDOMEN, SHIVERING, VOMITING	10	WNL	N	N	N	N	B	B	B
22	BACK PAIN,TACHYCARDIA, TACHYAPNOEA , HYPOTENSION	80	WNL	N	N	N	N	O	O	O
23	BACKACHE	20	WNL	N	N	N	N	O	O	O
24	SHIVERING ,FEVER	120	WNL	N	N	N	N	A	A	A
25	FEVER WITH CHILLS , SHIVERING	20	WNL	N	N	N	N	A	A	A
26	FEVER WITH CHILLS , SHIIVERING	150	WNL	N	N	N	N	AB	AB	AB
27	SHIVERING WITH BRONCHOSPASM	180	WNL	N	N	N	N	AB	AB	AB
28	BRONCHOSPASM WITH SHORTNESS OF BREATH	220	WNL	N	N	N	N	A	A	A
29	SHIVERING	10	WNL	N	N	N	N	B	B	B
30	RASHES , ICHING ,SHIVERING	100	WNL	N	N	N	N	O	O	O
31	RASHES , SWELLING AROUND EYE, TACHYCARDIA	200	WNL	N	N	N	N	A	A	A
32	BACKACHE , SHIVERING	20	WNL	N	N	N	N	B	B	B
33	TACHYCARDIA , SHIVERING	180	WNL	N	N	N	N	B	B	B
34	SHIVERING	80	WNL	N	N	N	N	O	O	O
35	FEVER , SHIVERING AND VOMITING	40	WNL	N	N	N	N	AB	AB	AB
36	FEVER , SHIVERING AND VOMITING	100	WNL	N	N	N	N	B	B	B
37	FEVER , SHIVERING	100	WNL	N	N	N	N	B	B	B
38	TACHYCARDIA	200	WNL	N	N	N	N	A	A	A
39	FEVER	180	WNL	N	N	N	N	AB	AB	AB
40	SHIVERING , CHILLS	200	WNL	N	N	N	N	B	B	B
41	SHIVERING , CHILLS	150	WNL	N	N	N	N	B	B	B
42	SHIVERING , CHILLS	290	WNL	N	N	N	N	B	B	B
43	RASHES, ITCHING	20	WNL	N	N	N	N	B	B	B
44	FEVER	80	WNL	N	N	N	N	A	A	A
45	FEVER , TACHYCARDIA	220	WNL	N	N	N	N	AB	AB	AB
46	TACHYCARDIA	20	WNL	P	P	N	N	B	B	B
47	SHIVERING , FEVER	20	WNL	N	N	N	N	B	B	B
48	FEVER , SHIVERING , CHILLS , DYSNOEA	180	WNL	N	N	N	N	O	O	O
49	FEVER , SHIVERING	100	WNL	N	N	N	N	AB	AB	AB
50	FEVER , SHIVERING , TACHYCARDIA	120	WNL	N	N	N	N	B	B	B
51	SHORTNESS OF BREATH	20	WNL	N	N	N	N	O	O	O
52	SHIVERING , CHILLS , FEVER	280	WNL	N	N	N	N	A	A	A
53	NAUSEA , PALPITATION	120	WNL	N	N	Y	N	B	B	B
54	SHORTNESS OF BREATH	100	WNL	N	N	N	N	A	A	A
55	FEVER (103) , SHIVERING	44	WNL	N	N	N	N	B	B	B

S. No.	PRE-TRANSFUSION Rh (D)	POST-TRANSFUSION CELL GROUPING	POST-TRANSFUSION SERUM GROUPING	POST TRANSFUSION ABO GROUPING	POST-TRANSFUSION Rh (D)	DONOR BAG CELL GROUPING	DONOR BAG SERUM GROUPING	DONOR BAG ABO GROUPING	DONOR BAG Rh (D)	PRE-TRANSFUSION SAMPLE COMPATIBLE /INCOMPATIBLE	POST-TRANSFUSION SAMPLE COMPATIBLE / INCOMPATIBLE	PRE-TRANSFUSION ICT
1	+	B	B	B	+	A	A	A	+	INCOMPATIBLE	INCOMPATIBLE	N
2	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
3	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
4	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
5	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
6	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
7	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	P,ANTI-C
8	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
9	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
10	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
11	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
12	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
13	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
14	-	B	B	B	-	B	B	B	-	COMPATIBLE	COMPATIBLE	N
15	-	B	B	B	-	B	B	B	-	COMPATIBLE	COMPATIBLE	N
16	-	O	O	O	-	O	O	O	-	COMPATIBLE	COMPATIBLE	N
17	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
18	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	P,ANTI-E
19	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
20	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
21	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
22	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
23	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
24	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
25	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
26	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
27	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
28	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
29	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
30	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
31	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
32	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
33	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
34	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
35	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
36	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
37	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
38	+	A	A	A	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
39	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
40	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
41	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
42	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
43	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
44	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
45	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
46	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
47	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
48	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
49	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
50	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
51	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
52	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
53	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
54	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
55	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N

S. No.	POST-TRANSFUSION ICT	PRE-TRANSFUSION DAT	POST-TRANSFUSION DAT	PLASMA Hb	URINE FOR FREE Hb	BLOOD BAG CULTURE	INTERPRETATION	ROOT CAUSE AND RISK FACTOR	CORRECTIVE ACTIONS TAKEN	PREVENTIVE ACTIONS
1	N	N	N	P	P	N	HEMOLYTIC TRANSFUSION REACTION	CLERICAL ERROR	STOP BT, INJ AVIL , FLUIDS SUPPORT	PROPER STAFF TRAINING
2	N	N	N	N	N	N	FNHTR	IDIOPATHIC	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
3	N	N	N	N	N	N	HYPOTENSIVE TRANSFUSION REACTION	IDIOPATHIC	STOP BT, INJ AVIL , FLUIDS SUPPORT	VITAL MONITORING
4	N	N	N	N	N	N	FNHTR	MULTIPE TRANSFUSIONS , CO-MORBIDITIES	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
5	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
6	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
7	P,ANTI-C	N	N	N	N	N	FNHTR	IMMUNOCOMPROMISED	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
8	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
9	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
10	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
11	N	N	N	N	N	N	FNHTR	IDIOPATHIC	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
12	N	N	N	N	N	N	FNHTR	IDIOPATHIC	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
13	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
14	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE LEUKODEPLETED PRBC
15	N	N	N	N	N	N	FNHTR	IMMUNOCOMPROMISED	STOP BT, INJ AVIL , INJ EFFCORLIN	USE LEUKODEPLETED PRBC
16	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
17	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE WASHED RBC'S
18	P,ANTI-E	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
19	N	N	N	N	N	N	FNHTR	IMMUNOCOMPROMISED	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
20	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	IMMUNOCOMPROMISED	STOP BT,INJ AVIL	USE WASHED RBC'S
21	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	INJ AVIL BEFORE TRANSFUSION
22	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , FLUIDS SUPPORT	INJ AVIL BEFORE TRANSFUSION
23	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , FLUIDS SUPPORT	INJ AVIL BEFORE TRANSFUSION
24	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
25	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
26	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
27	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	IMMUNOCOMPROMISED	STOP BT,INJ AVIL	INJ AVIL BEFORE TRANSFUSION
28	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	INJ AVIL BEFORE TRANSFUSION
29	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	INJ AVIL BEFORE TRANSFUSION
30	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	IMMUNOCOMPROMISED	STOP BT,INJ AVIL	INJ AVIL BEFORE TRANSFUSION
31	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	INJ AVIL BEFORE TRANSFUSION
32	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
33	N	2+	2+	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	IDIOPATHIC	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
34	N	N	N	N	N	N	FNHTR	IMMUNOCOMPROMISED	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
35	N	3+	3+	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
36	N	N	N	N	N	N	FNHTR	IDIOPATHIC	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
37	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
38	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	MONITOR VITALS	USE LEUKODEPLETED PRBC
39	N	N	N	N	N	N	FNHTR	IMMUNOCOMPROMISED	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
40	N	N	N	N	N	N	FNHTR	IMMUNOCOMPROMISED	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
41	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
42	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
43	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	IDIOPATHIC	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
44	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
45	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
46	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	IDIOPATHIC	STOP BT,INJ AVIL	MONITOR VITALS
47	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
48	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
49	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
50	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
51	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	VOLUME OVERLOAD, PLEURAL EFFUSION	STOP BT,INJ AVIL	SLOW INFUSION OF BLOOD COMPONENTS
52	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES , DM2 , ALD	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
53	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	MONITOR VITALS
54	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE PLASMA FREE BLOOD COMPONENTS
55	N	N	N	N	N	N	FNHTR	IDIOPATHIC	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC

S. No.	PATIENT NAME	AGE	AGE GROUP	SEX	MRD NUMBER	PLACE OF TRANFUSION	TYPE OF UNIT	UNIT NUMBER	DT OF UNIT COLLECTION	EXPIRY DT	DT AND TIME OF SUPPLY	DT AND TIME OF TRANSFUSION	TIME OF RECEIVING OF REACTION BAG WITH SAMPLE	ANY CLERICAL ERROR	TRANSFUSION HISTORY	DIAGNOSIS
56	RD	50	3	F	715694	HDHI RECOVERY	D	81106	26-11-2021	06-01-2022	28-11-2021 ; 3:00PM	28-11-2021; 3:15PM	28-11-2021 ; 7:00 PM	N	P	DOUBLE VALVE REPLACEMENT SX
57	R	25	2	M	1222115	ORTHO-M	D	82139	09-12-2021	19-01-2022	12-12-2021 ; 6:40AM	12-12-2021 ; 7:30AM	12-12-2021 ; 10 AM	N	P	PELVIC FRACTURE
58	PD	72	4	F	1223435	ICCU-2	D	82687	17-12-2021	27-01-2022	20-12-2021 ; 3:40PM	20-12-2021 ; 3:55PM	20-12-2021 ; 7:15 PM	N	N	DM2 , CAD , HTN , IVD , MR , LAD , HYPOTHYROID
59	VG	58	3	F	1214277	ICCU-2	D	82945	20-12-2021	30-01-2022	21-12-2021 ; 3:00PM	21-12-2021 ; 6:50PM	21-12-2021 ; 9:00 PM	N	P	AKI , CARDIOGENIC SHOCK
60	KS	94	4	M	1226297	HDHI ICCU-3	D	83193	22-12-2021	02-02-2022	24-12-2021 ; 6:40 PM	24-12-2021 : 7:55PM	24-12-2021 ; 10:15 PM	N	N	PULMONARY OEDEMA
61	AK	18	1	M	1229200	EMERGENCY-ICU 1	D	82947	20-12-2021	30-01-2022	25-12-2021 ; 1:10PM	25-12-2021 ; 1:50PM	25-12-2021 ; 5:00 PM	N	N	SUSPECTED PULMONARY OEDEMA
62	MR	35	2	F	1226761	ORTHO-M	D	83200	22-12-2021	02-02-2022	28-12-2021 ; 1:10PM	28-12-2021 ;1:30PM	28-12-2021 ; 2:40 PM	N	N	TOTAL HIP REPLACEMENT SX
63	R	23	2	M	72781	THALASSEMIA WARD	D	83842	29-12-2021	09-02-2022	02-01-2022 ; 2:00PM	02-01-2022 ; 2;30PM	02-01-2022 ; 3:00PM	N	P	THALASSAEMIA MAJOR
64	MK	19	1	M	1234223	SX- OT	D	83583	26-12-2021	06-02-2022	04-01-2022 ;8:30PM	04-01-2022 ; 8:50PM	04-01-2022; 10:30PM	N	N	SX
65	UR	50	3	F	740576	EMERGENCY-OT	D	84649	10-01-2022	20-02-2022	13-01-2022 ; 11:15AM	13-01-2022 ; 12:50PM	13-01-2022 ; 1:30PM	N	N	UPPER GI BLEED
66	K	76	4	F	226607	HDHI	D	84536	09-01-2022	19-02-2022	13-01-2022 ;5:30PM	13-01-2022; 7:00PM	13-01-2022; 9:30PM	N	N	POST CABG , HTN , ANEMIA , AF
67	GS	45	3	M	1223489	PLASTIC SX- OT	I	83111	22-12-2021	01-02-2022	14-01-2022 ; 8:40AM	14-01-2022 ; 9:45AM	14-01-2022 ; 12:30PM	N	P	CHRONIC ALCOHLISM , DEBRIDEMENT SX
68	GS	45	3	M	1223489	PLASTIC SX- OT	I	83082	21-12-2021	01-02-2022	15-01-2022 ; 2:35PM	15-01-2022 ;3:00PM	15-01-2022 ; 6:00PM	N	P	CHRONIC ALCOHLISM , DEBRIDEMENT SX
69	AR	40	2	F	1238785	GASTRO-ICU	I	85146	22-01-2022	04-03-2022	24-01-2022 ; 4:30PM	24-01-2022 ; 5:00PM	24-01-2022 ; 9:00PM	N	P	CIRRHOSIS WITH PORTAL HTN
70	GD	42	3	F	1244472	LABOUR ROOM	D	85642	29-01-2022	09-03-2022	31-01-2022 ; 11:00AM	31-01-2022 ; 11:20AM	31-01-2022 ; 2:00PM	N	N	LSCS
71	S	59	3	M	352509	HDHI	D	86395	06-02-2022	16-03-2022	09-02-2022 ; 5:45AM	09-02-2022 ; 6:15AM	09-02-2022 ; 9:00AM	N	N	DM2 , HTN ,CAD , POST CABG
72	MK	61	4	F	1251166	NS-OT	D	86427	06-02-2022	16-03-2022	11-02-2022 ; 4:00PM	11-02-2022 ; 6:45PM	11-02-2022 ; 9:20PM	N	N	CERVICAL SPINE INJURY
73	KR	61	4	M	1256909	GASTRO-ICU	D	87466	19-02-2022	09-04-2022	20-02-2022 ; 11:45PM	21-02-2022 ; 1:00AM	21 -02-2022 ; 3AM	N	P	LOWER GI BLEED
74	MK	34	2	M	46940	GASTRO-ICU	D	87597	21-02-2022	02-04-2022	22-02-2022 ; 10:00PM	22-02-2022 ; 11:00PM	23-02-2022 ; 1:00AM	N	P	ALD
75	J	46	3	M	1258338	EMERGENCY-OT	D	87591	21-02-2022	01-04-2022	22-02-2022 ;11:00PM	22-02-2022 ; 11:30PM	23-02-2022 ; 1:00AM	N	P	GUN SHOT INJURY
76	KS	52	3	M	1189659	EICU-2	D	87789	24-02-2022	06-04-2022	26-02-2022 ; 3:00PM	26-02-2022 ; 7:20PM	26-02-2022; 9:00 PM	N	P	POST COVID
77	TS	67	4	M	1266389	SX- OT	D	88858	06-03-2022	16-04-2022	21-03-2022 ; 11:20AM	21-03-2022 ; 12:00PM	21-03-2022 ; 2:00PM	N	P	RSA
78	SC	67	4	M	1046873	ONCO MED WARD	D	89731	14-03-2022	24-04-2022	23-03-2022 ; 11 :00 AM	23-03-2022 ; 11:40AM	23-03-2022 ; 2:00PM	N	P	MANTLE CELL LYMPHOMA
79	SB	14	1	M	108617	THALASSEMIA WARD	I	92887	15-03-2022	25-04-2022	24-03-2022 ; 1:30 PM	24-03-2022 ; 2:50PM	24-03-2022 ; 5: 15 PM	P	P	THALASSEMIA MAJOR

S. No.	SIGNS / SYMPTOMS	APP VOLUME IN BAG	VISUAL ASSESSMENT OF BAG AND TUBE	PRE-TRANSFUSION HAEMOLYSIS	PRE-TRANSFUSION ICTERUS	POST-TRANSFUSION HAEMOLYSIS	POST-TRANSFUSION ICTERUS	PRE-TRANSFUSION CELL GROUPING	PRE- TRANSFUSION SERUM GROUPING	PRE-TRANSFUSION ABO GROUPING
56	CHILLS	120	WNL	N	N	N	N	B	B	B
57	CHILLS	170	WNL	N	N	N	N	AB	AB	AB
58	SHORTNESS OF BREATH , (RR = 44) , RESPIRATORY DISTRESS	100	WNL	N	N	N	N	B	B	B
59	RASHES , ICHING	60	WNL	N	N	N	N	B	B	B
60	FEVER , SHORTNESS OF BREATH	250	WNL	N	N	N	N	B	B	B
61	FEVER , SHIVERING , TACHYCARDIA , TACHYAPNOEA , SPO2 DEC	120	WNL	N	N	N	N	A	A	A
62	NAUSEA AND HYPOTENSION	270	WNL	N	N	N	N	O	O	O
63	IMPENDING DOOM, HEADACHE	250	WNL	N	N	N	N	B	B	B
64	TACHYCARDIA , HYPOTENSION	170	WNL	N	N	N	N	O	O	O
65	SHIVERING , FEVER	100	WNL	N	N	N	N	A	A	A
66	CHILLS, RIGORS , SHIVERING	20	WNL	N	N	N	N	AB	AB	AB
67	SHIVERING , FEVER	120	WNL	N	N	N	N	O	O	O
68	SHIVERING , FEVER	200	WNL	N	N	N	N	O	O	O
69	SHORTNESS OF BREATH	100	WNL	N	N	N	N	B	B	B
70	CHILLS AND SHIVERING	150	WNL	N	N	N	N	B	B	B
71	CHILLS AND HYPERTENSION	40	WNL	N	N	N	N	B	B	B
72	FEVER , NAUSEA , RIGORS	100	WNL	N	N	N	N	O	O	O
73	FEVER , CHILLS	100	WNL	N	N	N	N	B	B	B
74	FEVER , CHILLS	100	WNL	N	N	N	N	B	B	B
75	CHILLS , RASHES	280	WNL	N	N	N	N	B	B	B
76	FEVER , CHILLS , RIGORS	270	WNL	N	N	N	N	O	O	O
77	CHILLS , RIGORS	200	WNL	N	N	N	N	AB	AB	AB
78	TACHYCARDIA , FEVER , NAUSEA , DYSNOEA	150	WNL	N	N	N	N	O	O	O
79	SHIVERING , BACKACHE	250	WNL	N	N	N	N	B	B	B

S. No.	PRE-TRANSFUSION Rh (D)	POST-TRANSFUSION CELL GROUPING	POST-TRANSFUSION SERUM GROUPING	POST TRANSFUSION ABO GROUPING	POST-TRANSFUSION Rh (D)	DONOR BAG CELL GROUPING	DONOR BAG SERUM GROUPING	DONOR BAG ABO GROUPING	DONOR BAG Rh (D)	PRE-TRANSFUSION SAMPLE COMPATIBLE /INCOMPATIBLE	POST-TRANSFUSION SAMPLE COMPATIBLE / INCOMPATIBLE	PRE-TRANSFUSION ICT
56	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
57	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
58	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
59	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
60	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
61	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
62	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
63	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	P,ANTI-K
64	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
65	+	A	A	A	+	A	A	A	+	COMPATIBLE	COMPATIBLE	N
66	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
67	-	O	O	O	-	O	O	O	-	COMPATIBLE	COMPATIBLE	N
68	-	O	O	O	-	O	O	O	-	COMPATIBLE	COMPATIBLE	N
69	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
70	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
71	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
72	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
73	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
74	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
75	+	B	B	B	+	B	B	B	+	COMPATIBLE	COMPATIBLE	N
76	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
77	+	AB	AB	AB	+	AB	AB	AB	+	COMPATIBLE	COMPATIBLE	N
78	+	O	O	O	+	O	O	O	+	COMPATIBLE	COMPATIBLE	N
79	+	B	B	B	+	B	B	B	+	INCOMPATIBLE	INCOMPATIBLE	P,ANTI-K

S. No.	POST-TRANSFUSION ICT	PRE-TRANSFUSION DAT	POST-TRANSFUSION DAT	PLASMA Hb	URINE FOR FREE Hb	BLOOD BAG CULTURE	INTERPRETATION	ROOT CAUSE AND RISK FACTOR	CORRECTIVE ACTIONS TAKEN	PREVENTIVE ACTIONS
56	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
57	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
58	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	USE PLASMA FREE BLOOD COMPONENTS
59	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE PLASMA FREE BLOOD COMPONENTS
60	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
61	N	N	N	N	N	N	FNHTR	MULTIPE TRANSFUSIONS , CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
62	N	N	N	N	N	N	HYPOTENSIVE TRANSFUSION REACTION	MULTIPE TRANSFUSIONS , CO-MORBIDITIES	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
63	P,ANTI-K	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	USE LEUKODEPLETED PRBC
64	N	N	N	N	N	N	HYPOTENSIVE TRANSFUSION REACTION	IDIOPATHIC	STOP BT,INJ AVIL	MONITOR VITALS
65	N	N	N	N	N	N	FNHTR	IDIOPATHIC	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
66	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
67	N	2+	2+	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE WASHED RBC'S
68	N	2+	2+	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE WASHED RBC'S
69	N	N	N	N	N	N	NON-SPECIFIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	TRAINING OF STAFF
70	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
71	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT ,PCM INFUSION	USE LEUKODEPLETED PRBC
72	N	N	N	N	N	N	FNHTR	ON MULTIPLE DRUGS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
73	N	N	N	N	N	N	FNHTR	MULTIPLE CO-MORBIDITIES	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
74	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
75	N	N	N	N	N	N	ALLERGIC TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT,INJ AVIL	INJ AVIL BEFORE TRANSFUSION
76	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
77	N	N	N	N	N	N	FNHTR	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
78	N	N	N	N	N	N	HYPOTENSIVE TRANSFUSION REACTION	MULTIPLE TRANSFUSIONS	STOP BT, INJ AVIL , PCM INFUSION	USE LEUKODEPLETED PRBC
79	P,ANTI-K	N	N	N	P	N	HEMOLYTIC TRANSFUSION REACTION	CLERICAL ERROR	STOP BT, INJ AVIL , FLUIDS SUPPORT	USE PHENOTYPE MATCHED BLOOD

Baba Farid University
of Health Sciences
Sadiq Road
Faridkot-151 203 (Pb). INDIA.
Phone : 01639-256232,256236
Tele/Fax : 01639-256235
Email – Examination@bfuhs.ac.in

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No. BFUHS/2K21p-TH/ 152 **Date** 05/01/22

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.10.2021 has approved the plan of thesis of **Jasmeet Kaur**, a student of your college for **MD Immuno Haematology & Blood Transfusion** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Evaluation of transfusion related adverse events due to packed red blood cells.

Supervisor
Dr. Sonia Gupta
Assoc. Prof.,
Dept. of I.H.B.T.,
DMCH, Ludhiana.

Co-Supervisor

Dr. Amarjit Kaur
Prof. & Head,
Dept. of I.H.B.T.,
DMCH, Ludhiana.

Dr. Rajesh Kumar
Prof.,
Dept. of I.H.B.T.,
DMCH, Ludhiana.

The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

S P Singh

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

61. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
62. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF MEDICINE

In

IMMUNOHEMATOLOGY AND BLOOD TRANSFUSION

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

MARCH 2021

DR. JASMEET KAUR

DEPARTMENT OF IMMUNOHEMATOLOGY AND BLOOD TRANSFUSION
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA
LUDHIANA, PUNJAB-141001

ABSTRACT OF PLAN OF THESIS

Title	EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS
For the degree of	M.D.
Name of the candidate	Dr. Jasmeet Kaur
Supervisor	Dr. Sonia Gupta, Associate Professor, Department of I.H.B.T, DMCH, Ludhiana
Co-supervisor	Dr. Amarjit Kaur, Professor & Head, Department of I.H.B.T, DMCH, Ludhiana Dr. Rajesh Kumar, Professor, Department of I.H.B.T, DMCH, Ludhiana
Institution	Dayanand Medical College and Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Transfusion of blood products is a double-edged sword and should be used judiciously. Improvements in donor screening and transfusion transmissible diseases testing procedures have led to a decrease in the hazards and risks that are associated with transmission of the infectious diseases associated with blood transfusion. However, the risks of non-infectious complications have become more apparent. These non-infectious complications called as adverse transfusion reactions (ATRs) can either be acute in nature or follow a delayed course. Knowledge of these ATRs will help us to prevent its occurrence by taking precautionary and adequate measures and ensuring blood safety.

Aim of Study: To evaluate the rate of transfusion reactions between leukoreduced and non leukoreduced red blood cells.

Materials & methods: For a period of one year all the adverse events related to transfusion of packed red blood cells in various clinical specialties will be recorded and evaluated.

Clinical Significance: To determine the rate and cause of transfusion related adverse events due to packed red blood cells in order to establish the safe blood transfusion for future.

Keywords: Prestorage leukoreduction, poststorage leukoreduction, transfusion Reactions, risk associated with transfusion.

Jasmeet Kaur		Amarjit	Ramesh	
(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS"** exist in the Department of Immunohematology and Blood Transfusion at Dayanand Medical College and Hospital, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis are genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

Dr. Sonja Gupta
Associate Professor
Department of I.H.B.T
DMCH, Ludhiana

Co-Supervisor

Dr. Amarjit Kaur
Professor & Head
Department of I.H.B.T
DMCH, Ludhiana

Dr. Rajesh Kumar
Professor
Department of I.H.B.T
DMCH, Ludhiana

Head of the Department

Dr. Amarjit Kaur
Professor & Head
Department of I.H.B.T
DMCH, Ludhiana

Place:

Date:

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Jasmeet Kaur
Department	Immunohematology and Blood Transfusion
Topic of Thesis	EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS
Likely date of appearing in PG examination	MAY-JUNE 2023
Date of enrollment	27th July 2020
Name of Head of Department	Dr. Amarjit Kaur
1) **Supervisor** 2) **Co-Supervisor**	Dr. Sonia Gupta Dr. Amarjit Kaur Dr. Rajesh Kumar
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / No

Dr. Sandeep Puri
Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1.	NAME OF THE CANDIDATE AND ADDRESS	Dr. JASMEETKAUR H. No 492, Haripura Colony, Near Spice Tower, Sangrur 148001
2.	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL, LUDHIANA
3.	COURSE OF STUDY AND SUBJECT	MD IMMUNOHEMATOLOGY AND BLOOD TRANSFUSION
4.	DATE OF ADMISSION OF COURSE	27th JULY, 2020
5.	TITLE OF THE TOPIC	EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

About five decades ago,whole blood was the only option in the picture in case of hematological problems. But this concept of only using the whole blood has changed after the introduction of various blood components such as packed red blood cells, platelet concentrates, plasma &cryoprecipitates.improvements in donor screening and transfusion transmissible diseases testing procedures have led to a decrease in the hazards and risks that are associated with transmission of the infectious diseases associated with blood transfusion.However, transfusion of blood and blood components are associated with adverse events.More than 90% of adverse reactions to transfusions are associated with the presence of white blood cells in blood components.It was believed that leukocytes and the bioactive mediators mainly cytokines generated by leukocytes in the transfused blood units greatly involved in the etiology of FNHTRs and other TAARs.Febrile non hemolytic transfusion reactions are common complications resulting after transfusion of allogeneic packed red blood cells .Transfusion related adverse events can either be acute in nature or follow a delayed course. The adverse reactions include ABO haemolytic reactions, allergic reactions, anaphylactic reactions, bacterial contamination, febrile non hemolytic transfusion reactions (FNHTR), HLAalloimmunization,graft versus host disease,transfusion related acute lung injury,transfusion related immunomodulation,transfusion of leukotropic viruses,such as cytomegalovirus(CMV), epsteinbarr virus (EBV) and human T CELL Lymphotropic virus (HTLV) etc.

Leukocytes are one of the cellular components of circulating blood and can produce severe adverse reactions to the recipient when transfused. More than 90% of adverse reactions are associated with the presence of white blood cells. Leukocytes release pro-inflammatory cytokines during storage which leads to release of endogenous

pyrogens and thus causing febrile transfusion reactions. Thus removal of leukocytes is recommended to avoid these adverse reactions.

Leukoreduced blood units help in minimizing febrile non haemolytic transfusion reaction, HLAalloimmunization, transmission of lymphotropic viruses and platelet refractoriness as compared to non leukoreduced units. Various studies have supported the evidence of a significant decrease in adverse transfusion reactions with leukoreduced packed red blood cells as compared to non- leukoreduced. The reduction of febrile non haemolytic transfusion reactions and other adverse reactions have taken a forefront in usage of Leukoreduced packed red blood cells.

Through this study, the extent, incidence and severity of transfusion reactions occurring with leukoreduced and non leukoreduced blood will be studied. This study will be useful in preventing transfusion related adverse events. Thus this study will help in ensuring blood safety. The main objectives of this study is to track the adverse events associated with transfusion of packed red blood cells and to help identify trends, recommend best practices and interventions require to improve patient care and safety

Multi transfused thalassemia patients are prone to transfusions related complications.study of these reactions and correlating them with leukoreduction of the transfused packed red blood cells(pRBCs) reduces transfusion complications due to the transfused leukocytes.

6.2 REVIEW OF LITERATURE

Transfusion of blood products is a procedure which is to be used judiciously.Donor screening and transfusion transmissible diseases testing procedures have decreased the transmission of the infectious diseases associated with blood transfusion. However, the risks of non-infectious complications have become more apparent. These non-infectious complications are called adverse transfusion reactions (ATR's). These can either be acute in nature or delayed.[1] Knowledge of these ATRs will help us to prevent its occurrence by taking precautionary and adequate measures.

The commonly encountered blood transfusion reactions include acute ABO hemolytic reactions, allergic reactions, anaphylactic reactions, bacterial contamination, and febrile nonhemolytic transfusion reactions.[2]

Nonhemolytictransfusion reactions are common complications.They typically occur during the time of transfusion, but can also arise within 4–6h after the transfusion. The frequency of febrile reactions in non leukoreduced RBCs has been estimated to be 0.5–6.8% of all units transfused.[3,4] Patients with a history of FNHTRs are at a 15% risk of recurrence of this type of reaction.[5] Most FNHTRs are self-limited; they are characterized by fever (>1°C), chills and rigors.Nausea, vomiting, dyspnea, and hypotension can also occur, although they are not considered to be life threatening.[3] Leukocytes are considered to be an important cause of FNHTRs; Leukocytes derived pro-inflammatory cytokines increase when stored because of active synthesis of cytokines by these cells.[6] The interaction between the recipient's cytotoxic antibodies and human leukocyte antigen (HLA) or leukocytes specific antigens located on donor WBC's, results in formation of antigen-antibody complexes leading to complement binding and release of endogenous pyrogens.[7] The removal of the leukocytes before storage will prevent this,thus leading to a reduction in the number of FNHTRs.[8] Despite the lack of change in cytokine levels during storage, prestorage leukoreduced (PrSLR) RBCs have

been associated with lower rates of FNHTR compared to post storage leukoreduced RBC units.[9,10] indications of leukoreduced pRBC are FNHTRs, HLAalloimmunization, platelet refractoriness and also prevent the transmission of leukotropic viruses such as cytomegalovirus (CMV), human T cell leukemia virus, and Ebsteinbarr virus.[11]

Following are some studies which have been done to justify the transfusion reactions in leukodepleted pRBCs and non leukodepleted pRBCs

In one of the studies in 2014,the transfusion of pRBC was studied in large cohort of thalassemic patients and transfusion reactions were correlated with the leukodepletion status of the blood products used.out of all reactions, 0.22% reactions occurred in category B (leukoreduction by buffy coat method) and 0.58% in category C(non leukoreduced PRBC) and no reaction noted in category A(leukodepletion by bedside filters).This study was done by Dr. AM Shanthala Devi ,KG Gaikhonlungpou.[12}

According to a study in 2016, total incidence of Transfusion Reaction was found to be 0.38%, whereas in similar studies by University of Puerto Rico, Auckland Regional Blood centre and North India,incidence was 0.2%, 0.34%, 0.18% and 0.05% respectively.[13-16]

The overall rate of Transfusion Reactions with non leukoreduced RBCs was 0.54% which is comparable with those reported for non leukoreduced pRBCs.[3,5,12] This study shows rate of Transfusion reactions in Prestorage leukoreduced RBCs was 0.13% and in a similar study by King et al. [18]Yazer et al. [19] and Shanthala Devi,[12] the rates of TRs were 0.40%, 0.69% and 0.26%.

They found a significant difference in the incidence of FNHTRs, that is, 0.05% versus 0.24% in PrSLR and non-leukoreduced RBCs. This study is done by Dr. Rajesh k et al.[17]

In another study in the same year 2016 by Dr RitiTusharKantiSinha, Dr Rai P, Dey A; females were more affected than males similar to the study by Sidhu et al.[20] However, Kumar et al.[16] in their study found

males to be more affected than females.An allergic reaction may vary from only fever or urticaria to the presence of wheezing and angioedema. Among non- hemolytic transfusion reactions allergic reactions occur most frequently. In that study, 5 out of the 11 cases of allergic reaction had hypereosinophilia. Other than allergies, dermatological disorders, parasitic infections, bacterial infections, collagen vascular diseases, side effects of medications, and myeloproliferative diseases can also lead to an increase in eosinophil count. These conditions need to be ruled out.

Allergic reactions to unknown components in donors' blood are common mast cell stimulation, immunologically active food allergens in donor plasma or less commonly antibodies from an allergic donor can act as triggering events in allergic reactions. These usually present as urticaria or erythematous lesions and respond to antihistamine therapy. Anaphylactic reactions were categorized as those having systemic symptoms including hypotension and/or loss of consciousness and/or shock.[15]

In this study, the highest incidence of transfusion reactions was found to be allergic in nature. The overall incidence of allergic reactions was found to be 0.19% in this study. In all these cases, transfusion of whole blood was implicated. Sidhu et al.,[20] Kumar et al.,[16] and Domen and Hoeltge[21] found an incidence of allergic reactions 0.11%, 0.028%, and 0.02%, respectively, in their studies.

In a study by Dr. K. Mahesh Kumar, Dr.ChintakindiSravan, Dr.Sudhirkumarvujhini in 2017; it was found that using leukoreduced filters,one can achieve four log reduction of the total leukocyte count. When the unit of blood (approximately 450 ml) is collected there will be 4,000 to 11,000 WBCs /cu.mm, sometimes still higher count. Even after the blood component processing, 90% of these white blood cells remain with the RBCs, 8% of these white blood cells remain with the platelets as mononuclear cells;and 2% of cells remain in an unit of

fresh frozen plasma.Leukoreduction is done to reduce the number of white blood cells in the blood unit.[22] Indications of Leukoreduction are

1) Reduction of non-haemolytic transfusion reactions,

2) Reduction of HLAalloimmunization that may lead to patients becoming refractory to platelet transfusions e.g. patients requiring long term platelet therapy as in Aplastic anaemia and MDS,

3) Reduction of CMV transmission e.g. in patients awaiting organ transplantation,

4) Reduction in the risk of Yersinia enterocolitica contamination of RBC,

5) Possible reduction of Prion Disease,

6) Reduction in the incidence of transfusion associated Graft Versus Host Disease (TA-GVHD).[22]

In a study, done in 2018 by chin chunchang,taichenlee,ming-jangsu,hsiuchenlin,fang-yicheng,yi-ting chen et al results indicated that prevalence of TAARs was significantly reduced in the transfusions of pre-Leukoreduced packed red blood cells when compared with that in the transfusions of post-Leukoreduced. Particularly, the prevalence of FNHTRs was significantly reduced in the pre-Leukoreduction RBC transfusions when compared with that in the transfusion of post-LeukoreductionRBCs and the prevalence of allergy reactions was markedly reduced in the pre-LR PH transfusions. In vitro evaluation of cytokines in the pre- and post-LR blood components revealed that IL-1β, IL-8 and RANTES levels were significantly elevated in the post leukoreduced red blood cells. Similarly IL-1β, IL-6 and IL-8 levels were significantly elevated in the post-LRPHs when compared with those in the preLRPHs during the storage. These findings suggested that prestorageleukoreduction had a diminishing effect on the development ofTAARs, which could be associated with less accumulation of cytokines in the stored blood components. this study done by drchih-chunchang et al.[23]

In a study by Prasun Bhattacharya et al, fever was observed in 25 patients out of 43 characterized as FNHTR. In one study of 108 reactions characterized by chills, cold or rigors, only 18 involved a rise in temperature.[24] With the concept of universal leukoreduction there is risk reduction for FNHTR. The most common quoted rate for FNHTR is 0.5-1%[25] for the general populations of patients with red cell (WB/PRBC) transfusion. In other studies it varies from 0.08% to 6.8%.[4,26] A comparative study on incidence of FNHTR in leukoreduced vs. non leukoreduced blood components showed that the incidence is 0.12% in non leukoreduced and 0.08% in prestorage leukoreduced blood.[9] in this study, with transfusion of the non leukoreduced packed red cells has shown the overall risks for FNHTR to be 0.114% (43 out of 37,550) which is comparable to the reported data of non leukoreduced blood components. 1 Definitions of allergic reactions vary greatly. Moore et al.[2] reported a 3% rate of mild allergic reactions. This mild allergic reaction was defined as hive or localized urticaria. Incidence in other studies varies from 0.2% to 3%.[2,23-25]

6.3 AIMS AND OBJECTIVES OF THE STUDY

To evaluate transfusion related adverse events due to packed red blood cells.

7. MATERIALS AND METHODS

Patients will be stratified by type of the blood component and date of reaction and divided into two groups:

1) Patients who received allogeneic prestorageleukoreduced and post storage leukoreduced red blood cells.

Leukoreduced packed red blood cells with inline filters provides 3 log reduction by using sepacell RC pure filter (99.9%) and bedside filters BPF4 (paul medical) provides the same amount of leukoreduction.

2) Allogeneic non leukoreduced red blood cells

Non-leuko-reduced packed cells provide log 1 (90%)by centrifugation and removal of the buffy coat gives 1 log reduction of leukocytes in a unit.

SAMPLE COLLECTION

All the transfusion reactions related to RBC transfusion are to be evaluated.

7.1 SOURCE OF DATA

All the transfusion reactions Related TO RBC as following

1) Patients who received allogeneic Prestorageleukoreduced and post storage leukoreduced red blood cells(2) allogeneic non leukoreduced red blood cells.

7.2 METHOD OF COLLECTION OF DATA

Inclusion Criteria:

Patient requiring multi transfusions :-

1. Thalassemia
2. Oncology
3. ICU’s
4. Heart patients
5. Surgery patients

Exclusion Criteria: transfusion reactions related to

platelets concentrate ,fresh frozen plasma ,single donor platelets apheresis ,single donor plasma apheresis,cryoprecipitates and whole blood.

OUTCOME

At the end of this study we will be able to tell the efficacy of various leukoreduction techniques and their effect on the transfusion related adverse events.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations will be done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

No.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3 ?

Attached here with.

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PROFORMA

S.No

Patient Name

Age/Sex

MRD No.

Place of Transfusion

Bag No.(S/D/T/Q/I)

Bag lot No./Exp

Dt. of unit collection

Exp. Dt.

Date & Time of supply

Date & Time Of transfusion

Time of receiving of reaction bag with sample

Any clerical Error:(Yes/No)

Transfusion History

Diagnosis

S/S

Appox. Volume in bag

Vlisual assessment of bag and tube

VISUAL ASSESSMENT OF BLOOD SAMPLE

PRE-TRANSFUSION:

Haemolysis Icterus

POST TRANSFUSION:

Haemolysis Icterus

Signature of Candidate **Signature of Supervisor**

BLOOD SAMPLE	CELL GROUPING	SERUM GROUPING	ABO GROUPING	Rh(D)
Pre-transfusion				
Post transfusion				
Donar Bag/tube				

RE-CROSSMATCHING

Pre-Transfusion Sample:

Compatible In-Compatible

Post-Transfusion Sample

Compatible In-Compatible

Antibody Screening and identification

Post-Transfusion blood sample: DAT: Pre

Post

Plasma Hb

Total Bilirubin Direct Indirect

Urine Sample for Free Hb

Blood Bag Culture

INTERPRETATION

Signature of Candidate **Signature of Supervisor**

Patient safety and quality of care NABH Accredited
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

(To be submitted to quality and safety department within 48 hours)

EVENT ANALYSIS

AREA/DEPT:- _____ Patient Name _____
MRD NO._____

Incident/Event_____
_____
_____

Patient
Background_____
_____
_____

Root cause and Risk factor
_____
_____

Corrective Actions
_____
_____

Preventive actions
/Recommendations:_____
_____

Signature of Technician . Signature of consultant/Team mate

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o..... .....am willing to participate in the study **"EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name:

Signature of Supervisor **Signature of Candidate**

मरीज अनुमति फार्म

तिथि _____

मैं _____पत्नी/पुत्र/पुत्री _____ निवासी _____ इस शोधकार्य **"EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोख़िम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है। मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____ਵਾਸੀ

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"EVALUATION OF TRANSFUSION RELATED ADVERSE EVENTS DUE TO PACKED RED BLOOD CELLS" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

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ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਪਤਾ _____

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ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਪਤਾ _____

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ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

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ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ